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Chen et al.

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(54) **LIGHT-EMITTING ELEMENT WITH CRACK PREVENTING CUSHION**

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(63) Continuation of application No. 15/669,613, filed on Aug. 4, 2017, now Pat. No. 10,153,402, which is a (Continued)

(51) **Int. Cl.**
H01L 23/00 (2006.01)
H01L 33/44 (2010.01)
(Continued)

(52) **U.S. Cl.**
CPC **H01L 33/44** (2013.01); **H01L 23/562** (2013.01); **H01L 33/02** (2013.01); **H01L 33/38** (2013.01); **H01L 33/40** (2013.01); **H01L 33/62** (2013.01)

(58) **Field of Classification Search**
CPC H01L 33/44; H01L 33/02; H01L 33/40; H01L 33/38; H01L 33/62
See application file for complete search history.

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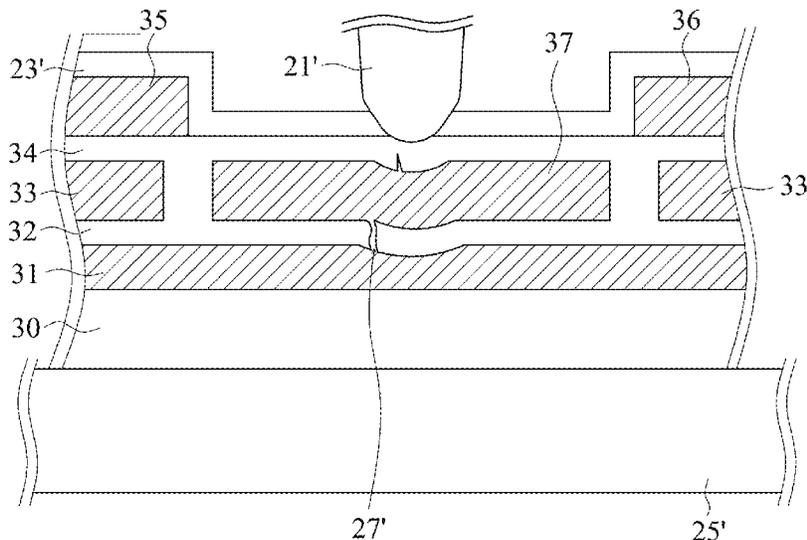
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(57) **ABSTRACT**

A light-emitting element includes a semiconductor light-emitting stack including a first semiconductor layer, a second semiconductor layer formed on the first semiconductor layer, and an active layer formed therebetween; a first conductive layer disposed on the second semiconductor layer and electrically connecting the second semiconductor layer; a second conductive layer disposed on the second semiconductor layer and electrically connecting the first semiconductor layer; and a cushion part disposed on and directly contacts the first conductive layer, wherein in a top view, the cushion part is surrounded by and electrically isolated from the second conductive layer.

19 Claims, 21 Drawing Sheets



Related U.S. Application Data

continuation of application No. 14/948,733, filed on Nov. 23, 2015, now Pat. No. 9,761,774.

(60) Provisional application No. 62/092,422, filed on Dec. 16, 2014.

(51) **Int. Cl.**

H01L 33/62 (2010.01)
H01L 33/38 (2010.01)
H01L 33/02 (2010.01)
H01L 33/40 (2010.01)

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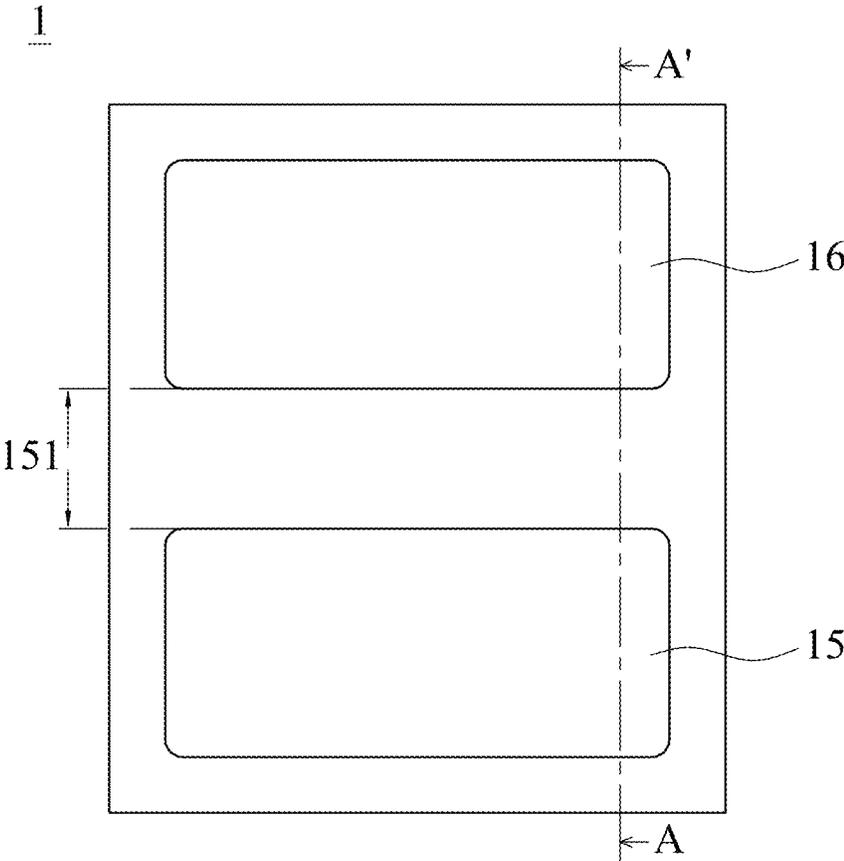


FIG. 1A

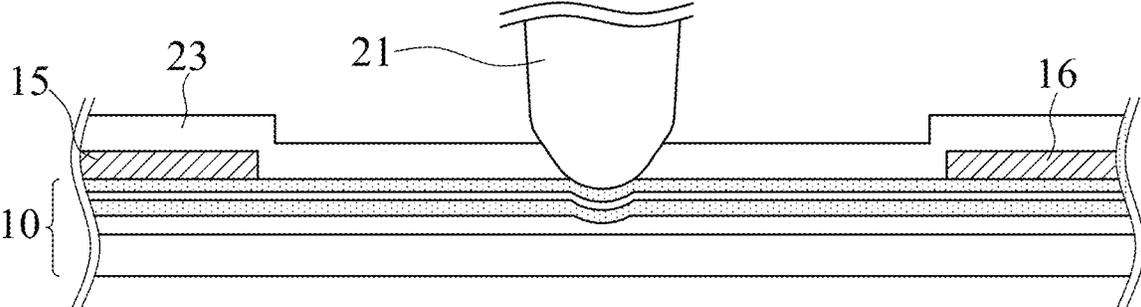


FIG. 1B

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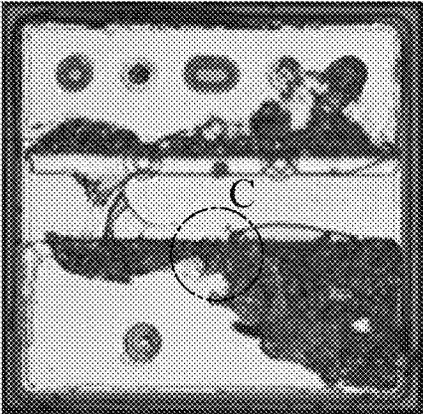


FIG. 2A

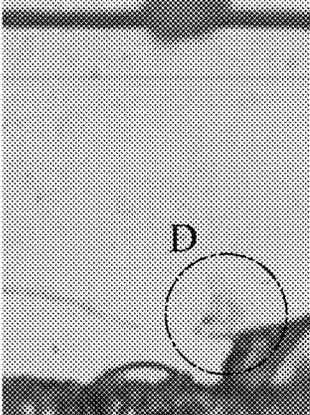


FIG. 2B

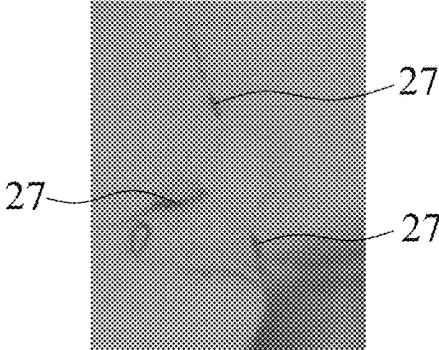


FIG. 2C

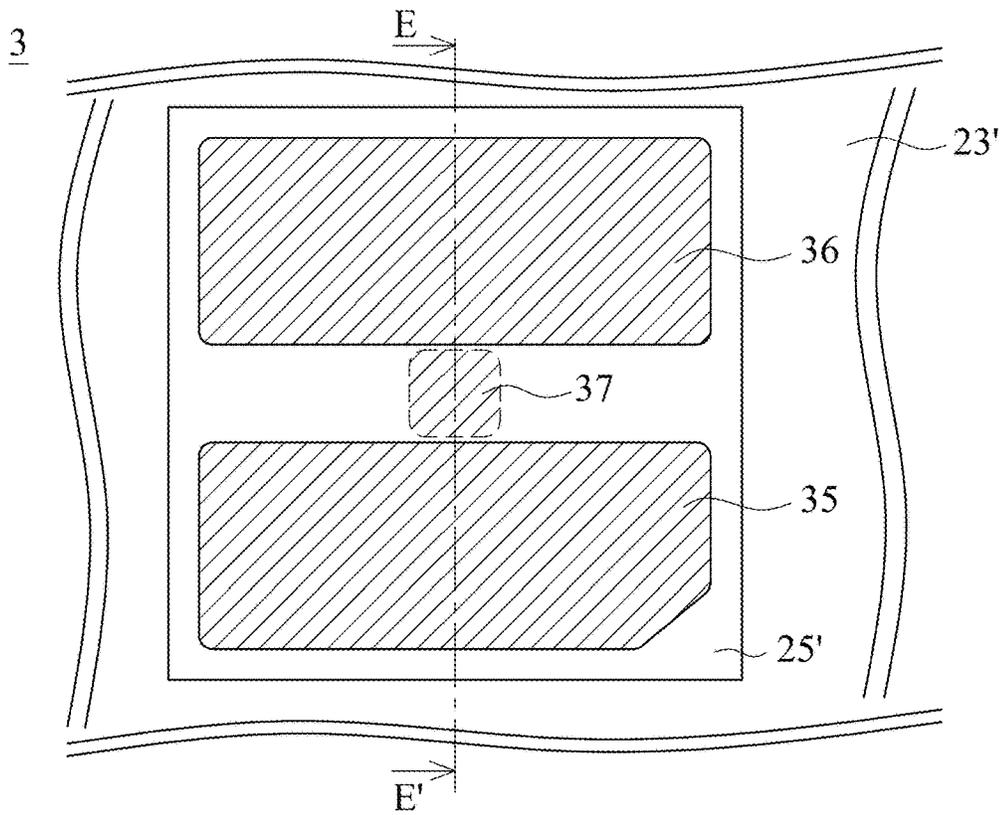


FIG. 3A

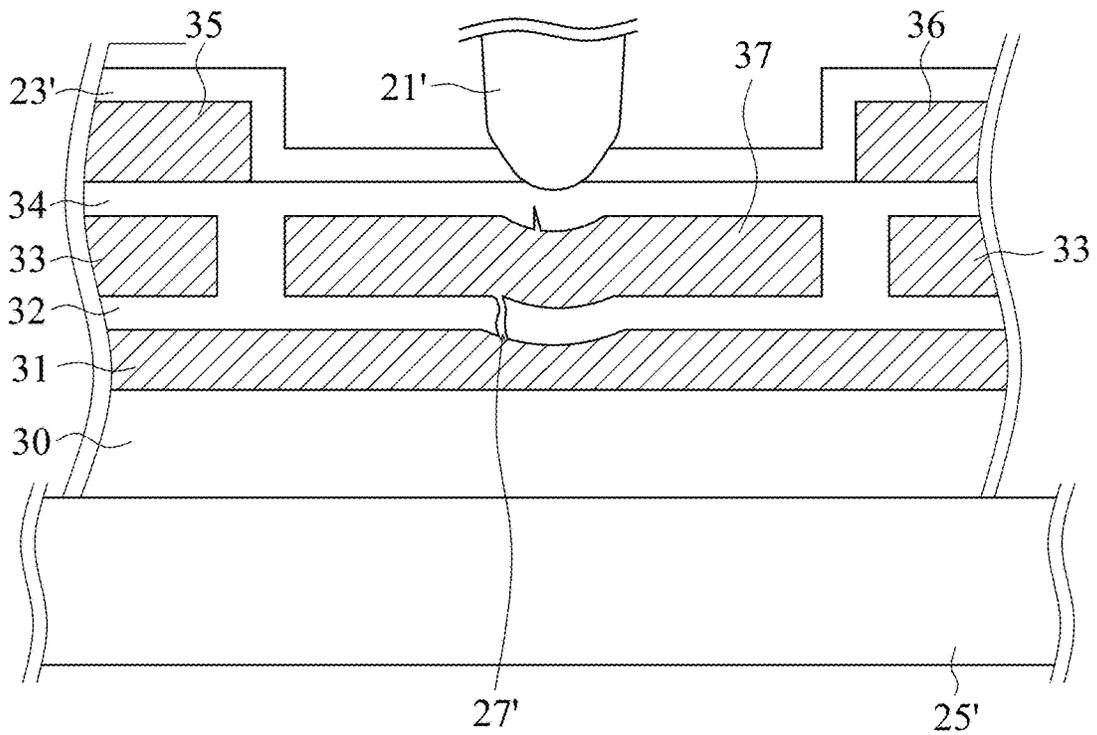


FIG. 3B

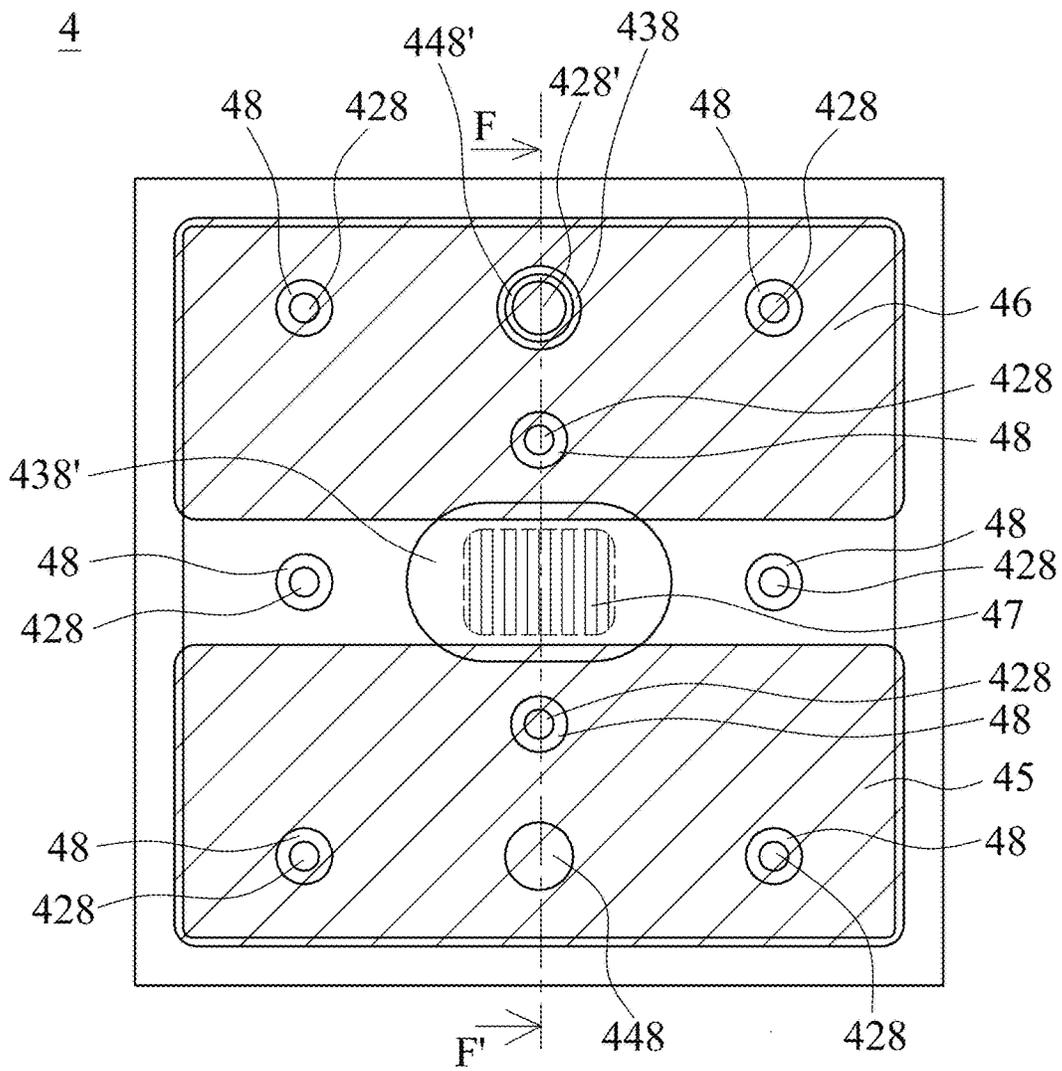


FIG. 4A

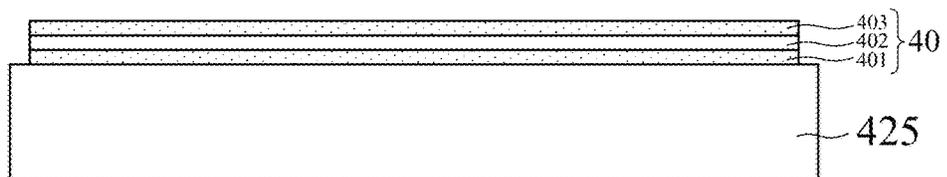


FIG. 4B

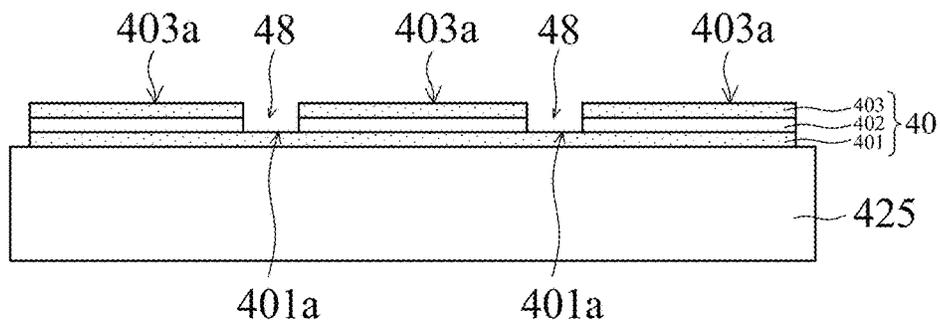


FIG. 4C

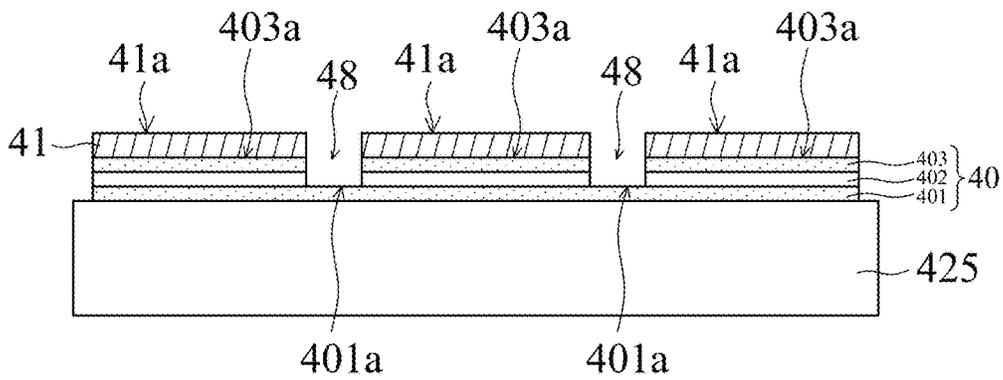


FIG. 4D

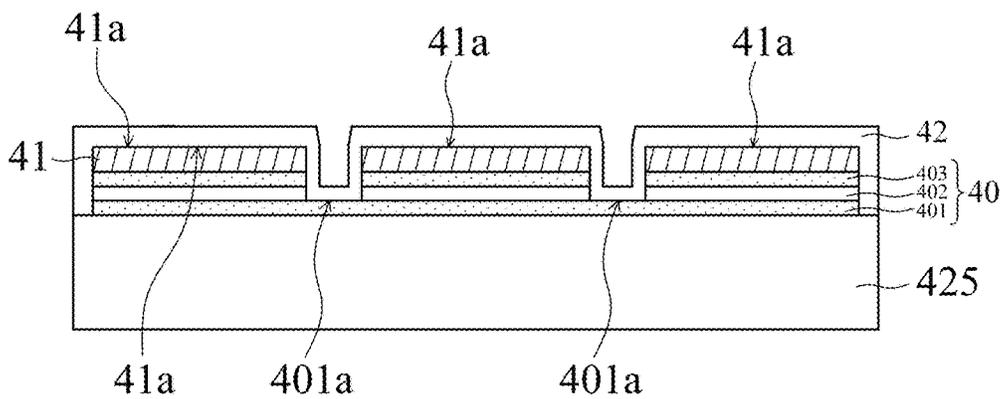


FIG. 4E

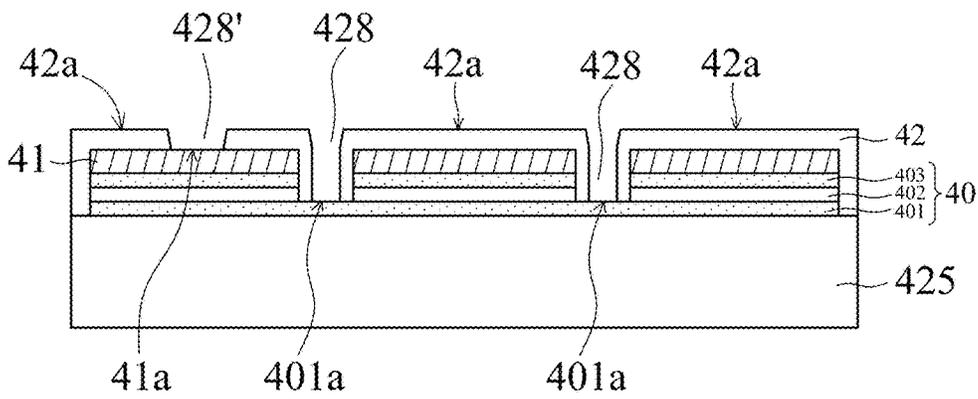


FIG. 4F

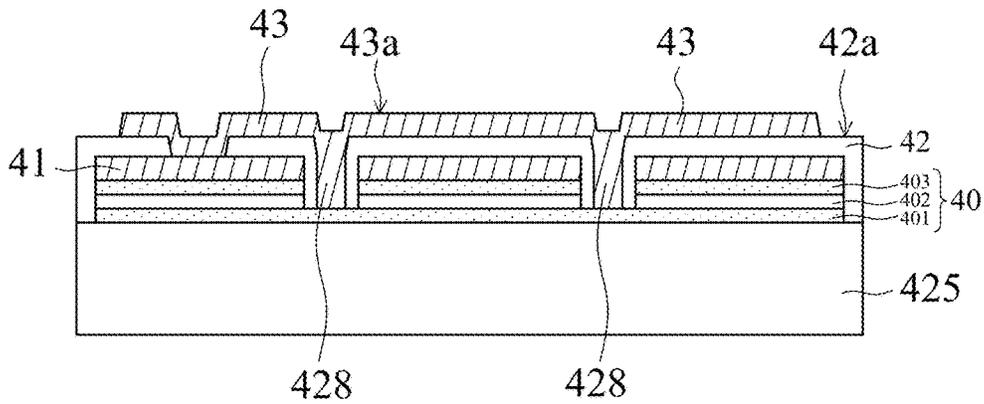


FIG. 4G

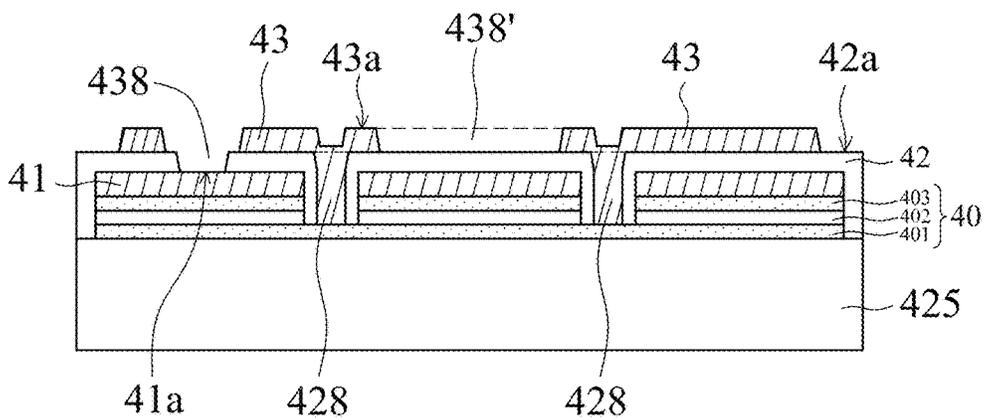


FIG. 4H

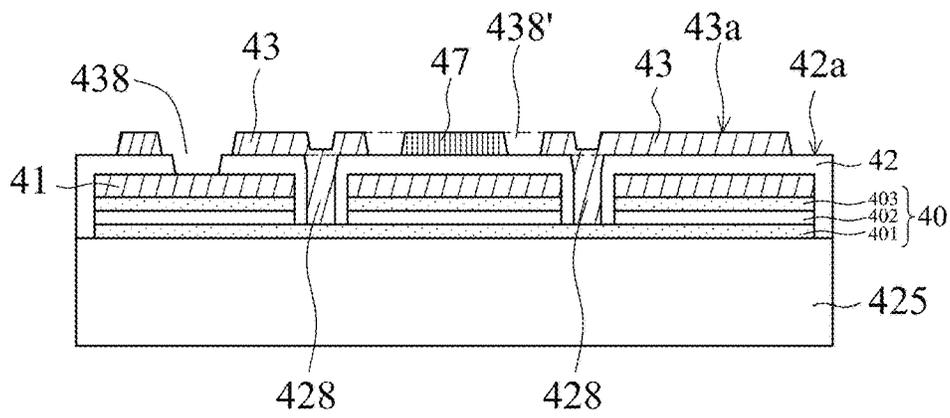


FIG. 4I

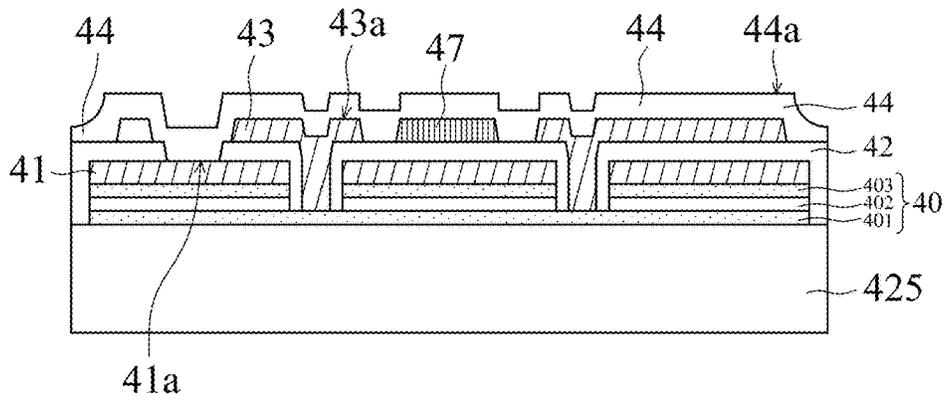


FIG. 4J

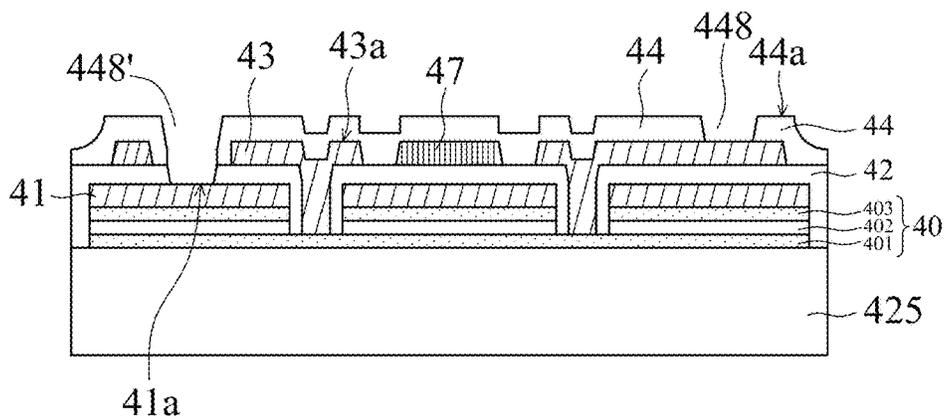


FIG. 4K

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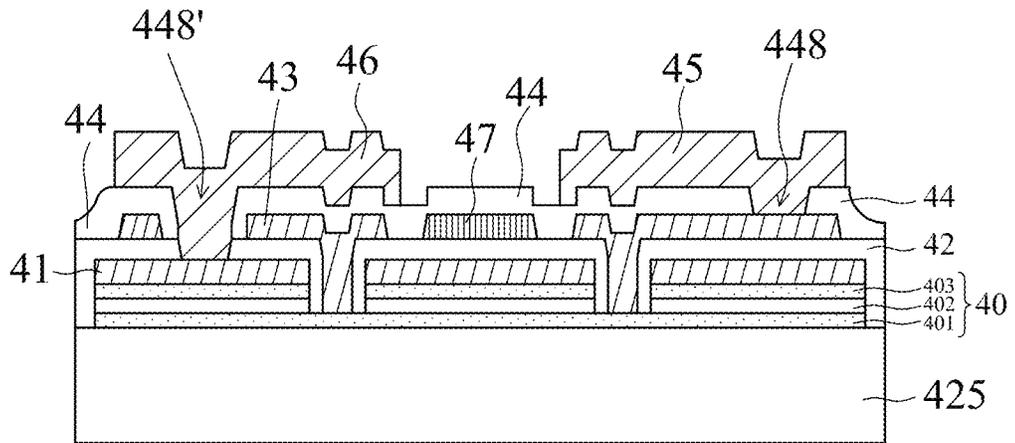


FIG. 4L

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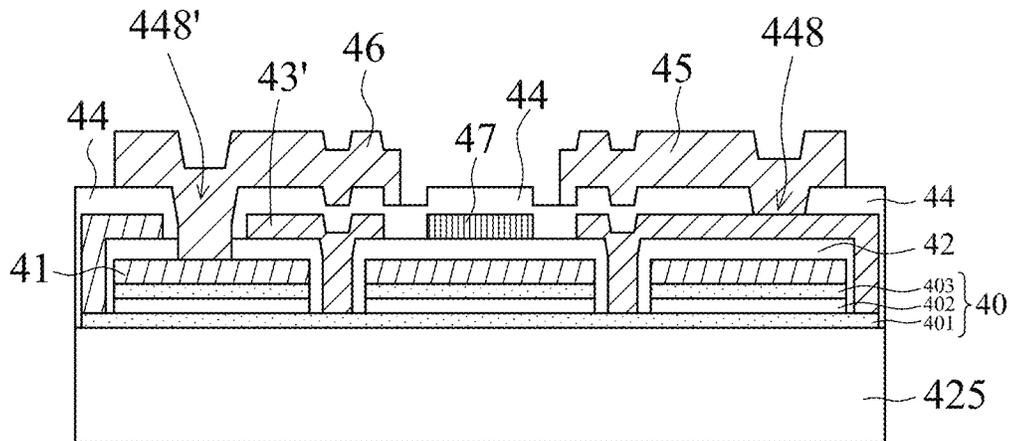


FIG. 5

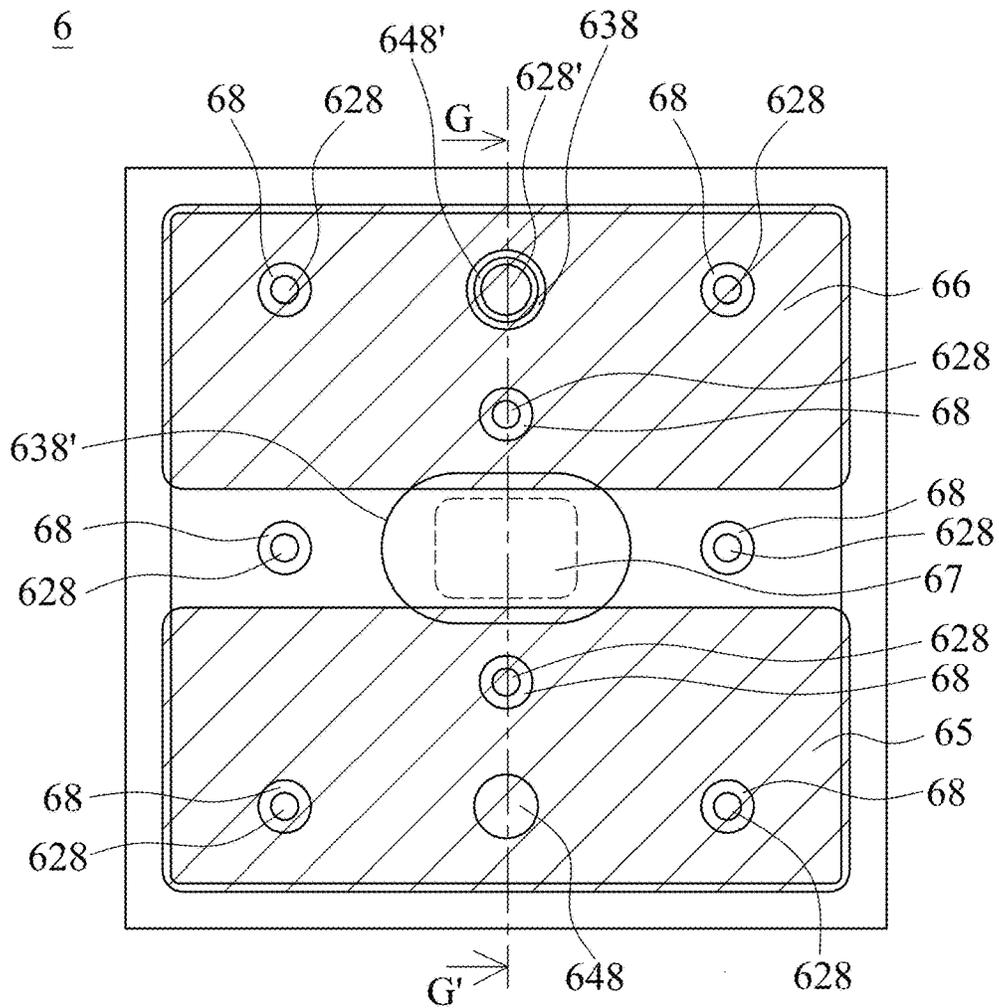


FIG. 6A

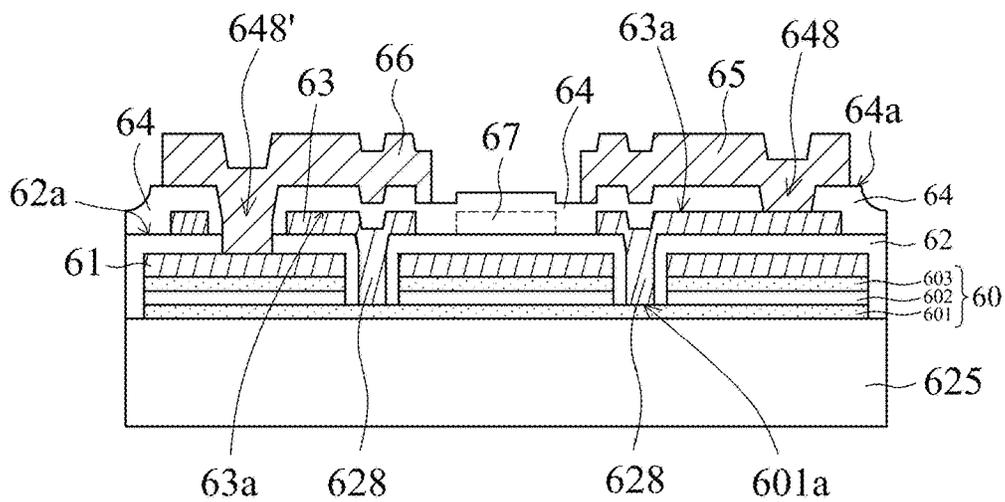


FIG. 6B

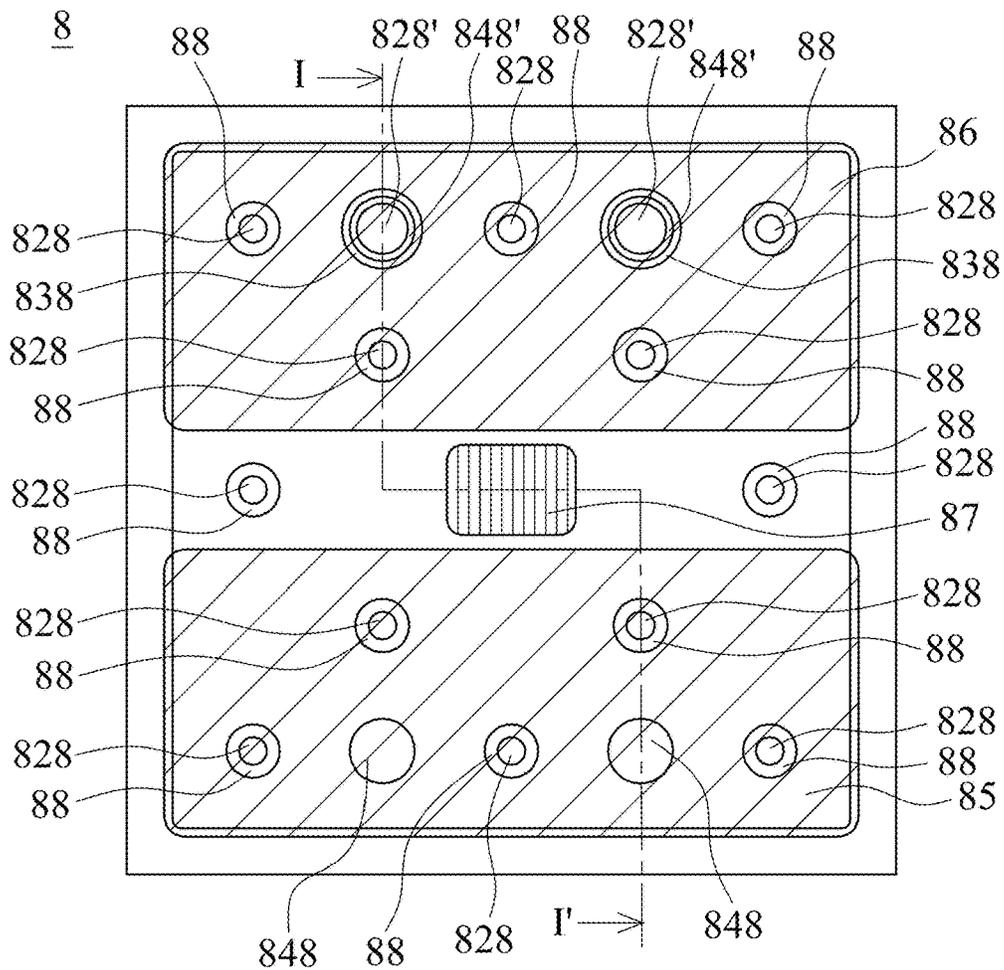


FIG. 8A

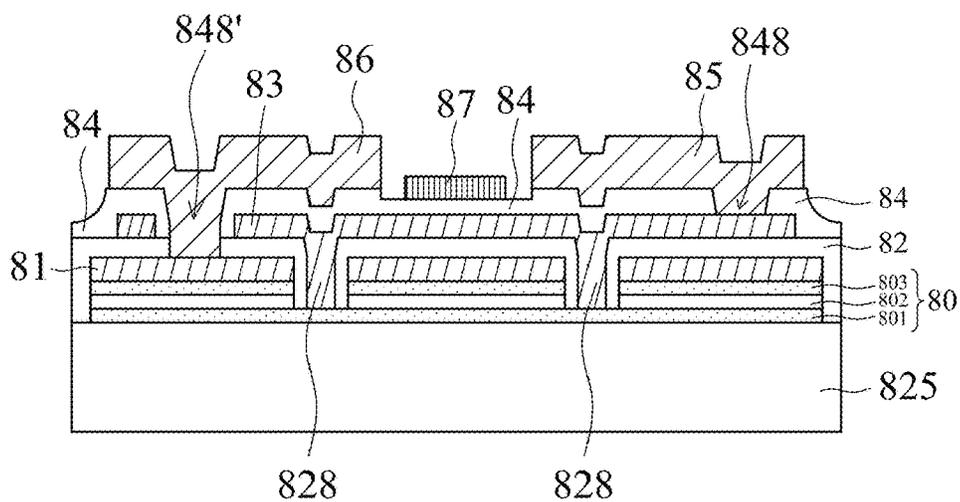


FIG. 8B

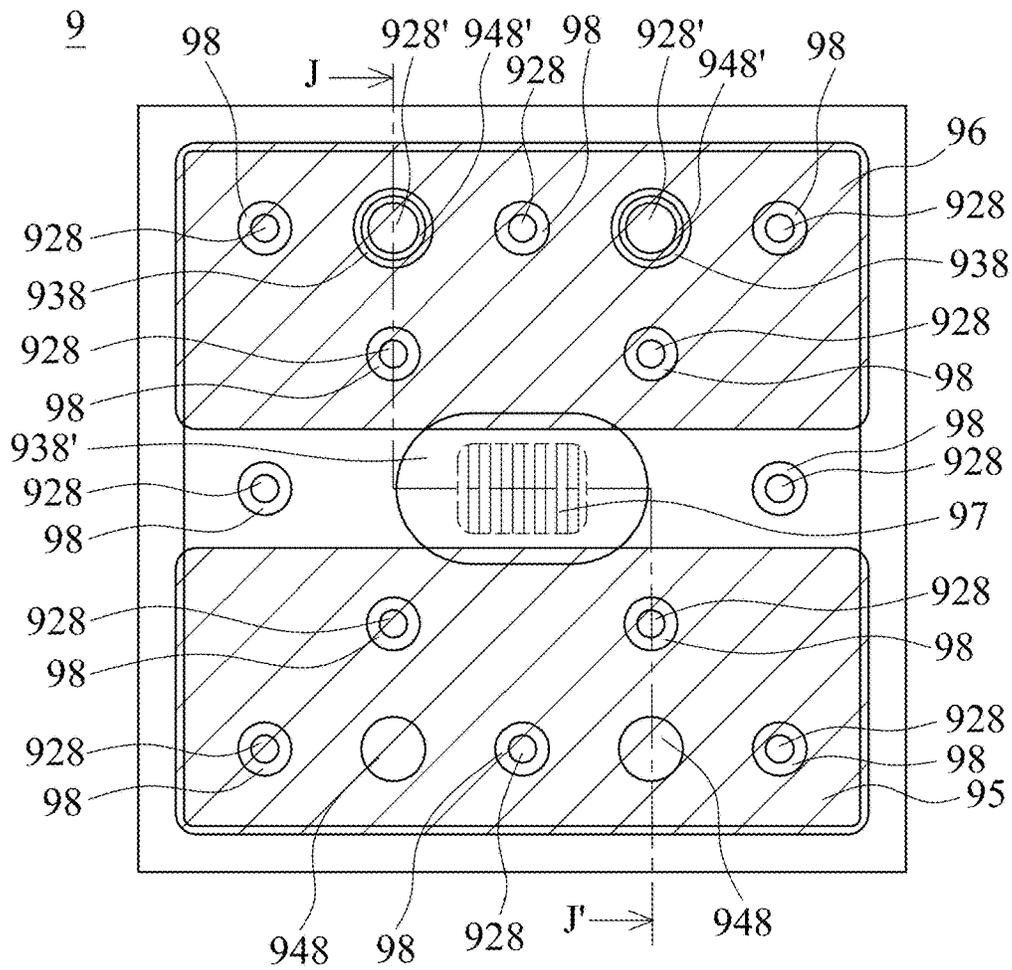


FIG. 9A

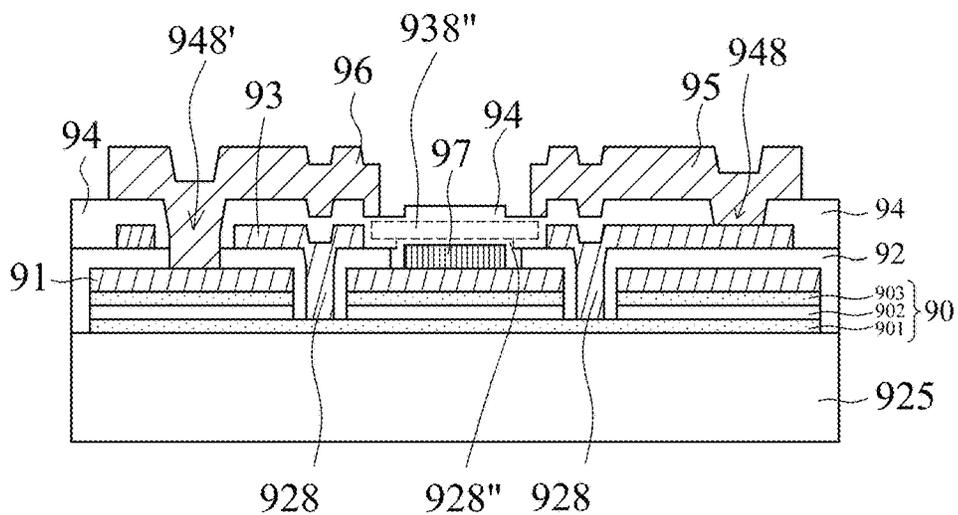


FIG. 9B

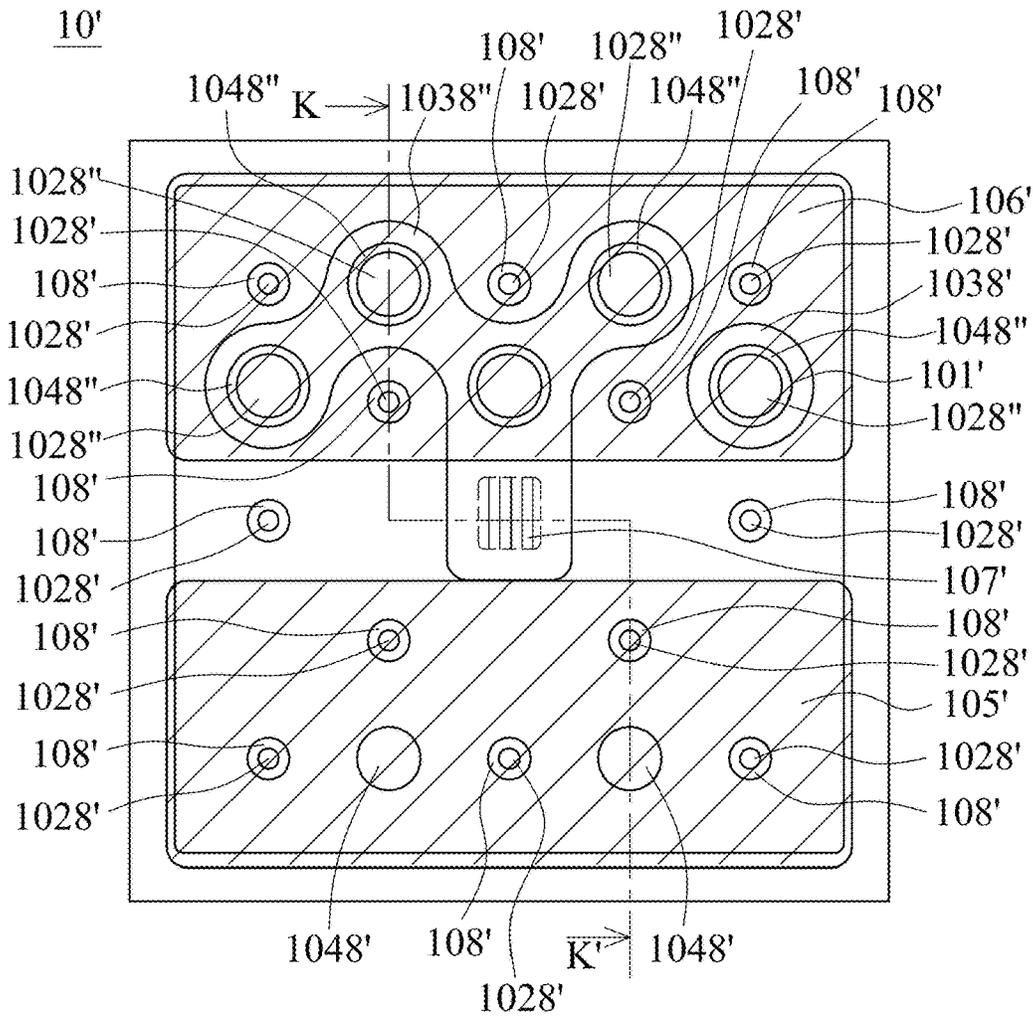


FIG. 10A

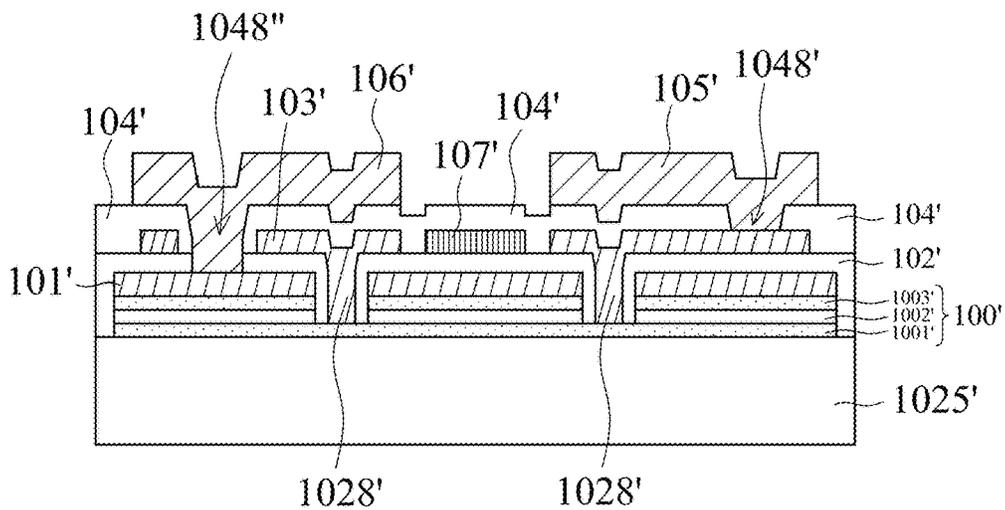


FIG. 10B

11'

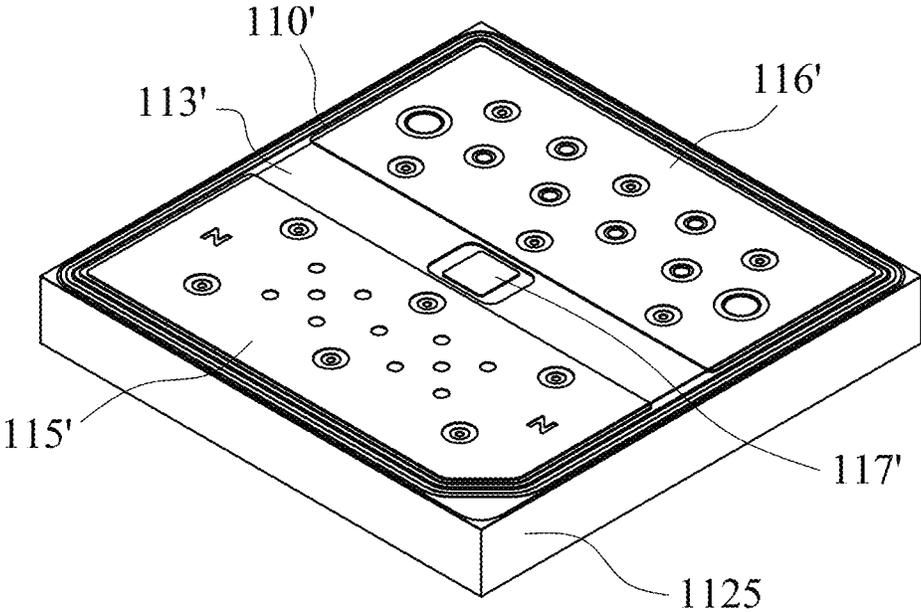


FIG. 11A

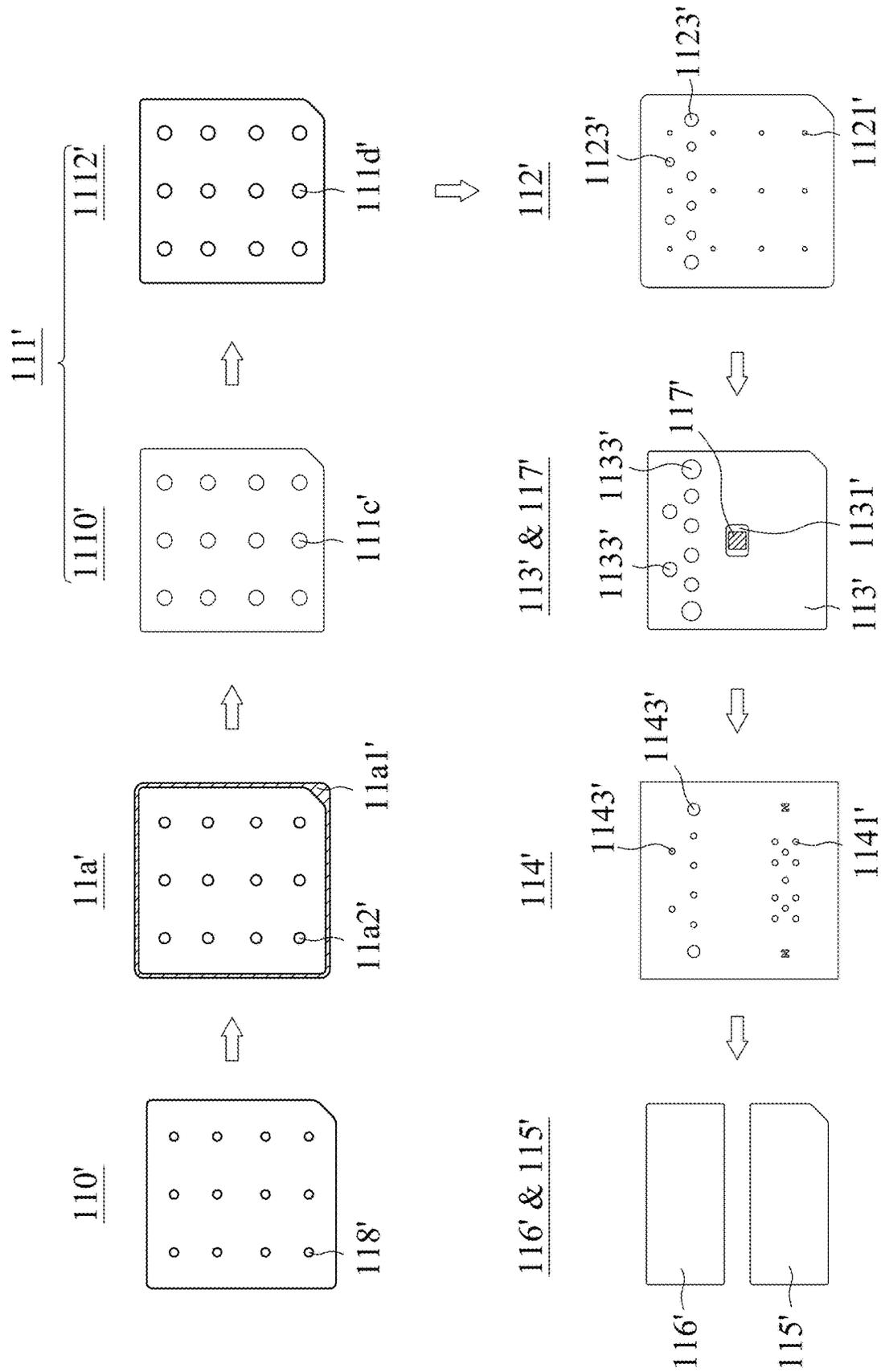


FIG. 11B

12'

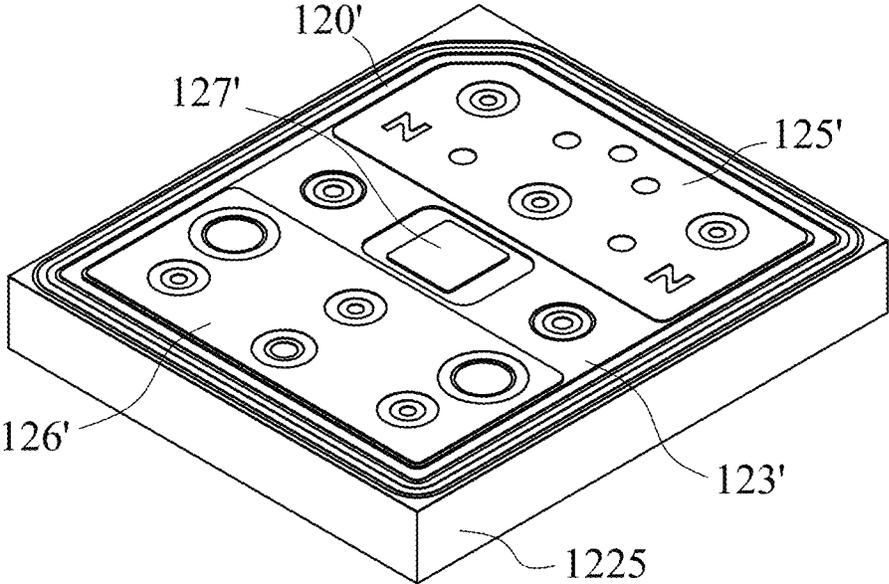


FIG. 12A

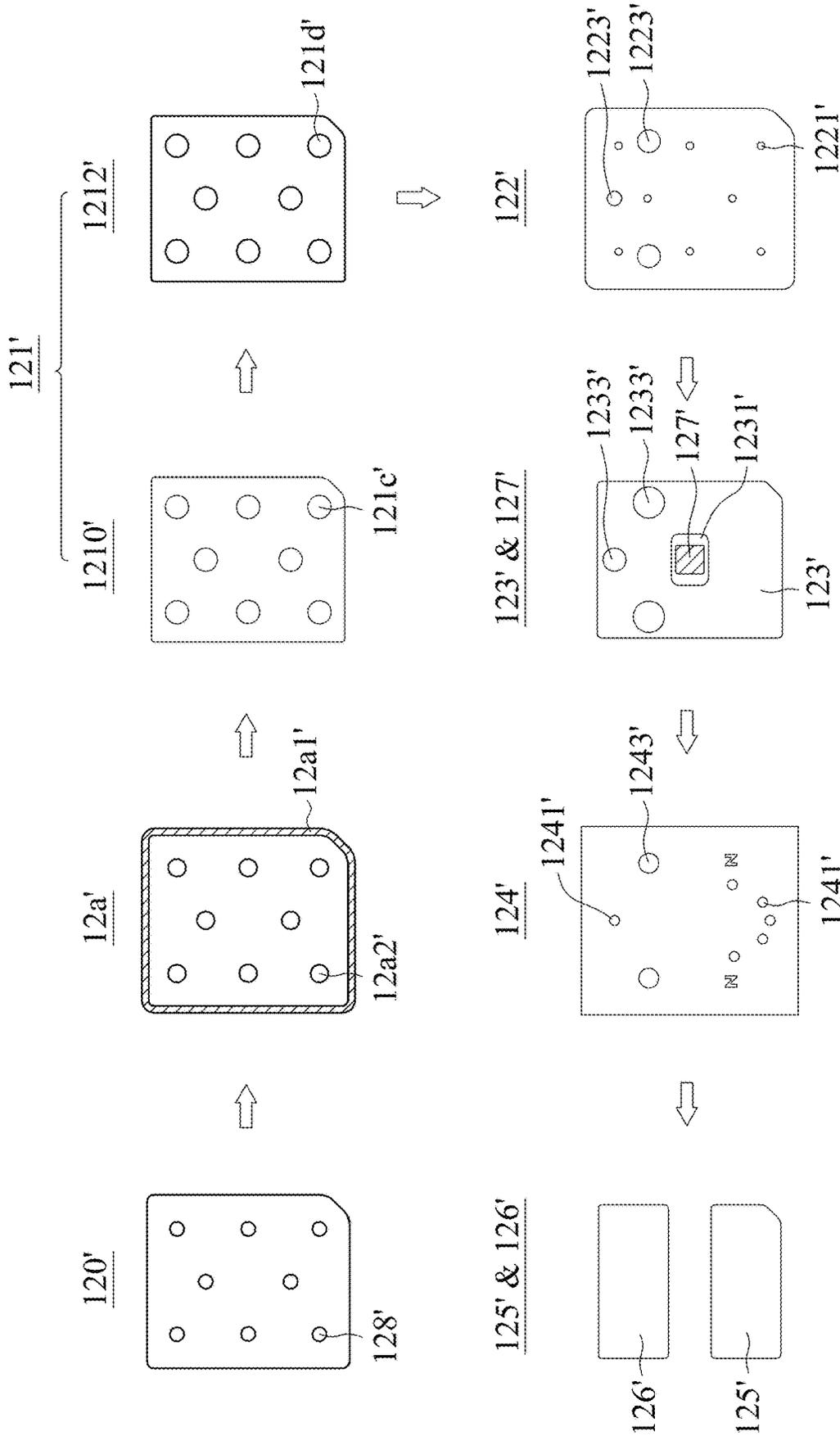


FIG. 12B

13'

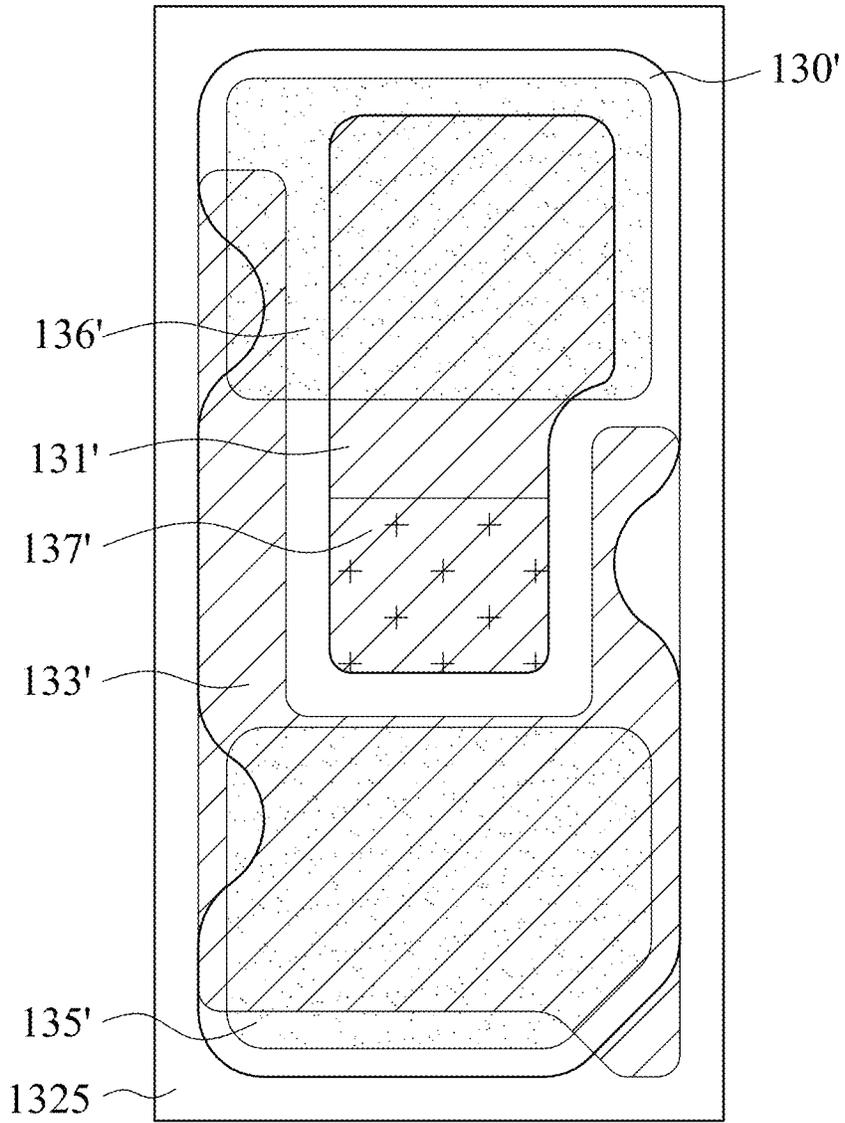


FIG. 13A

14'

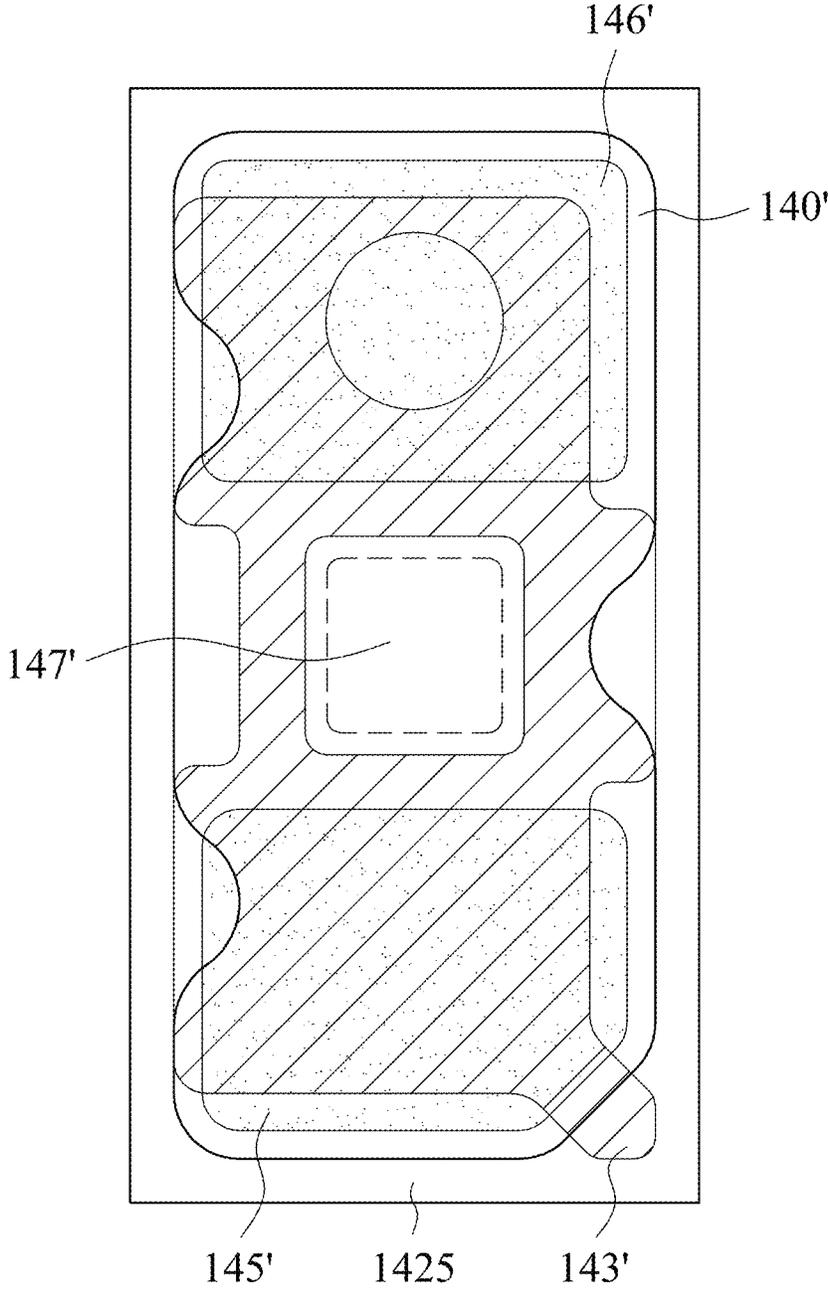


FIG. 13B

15'

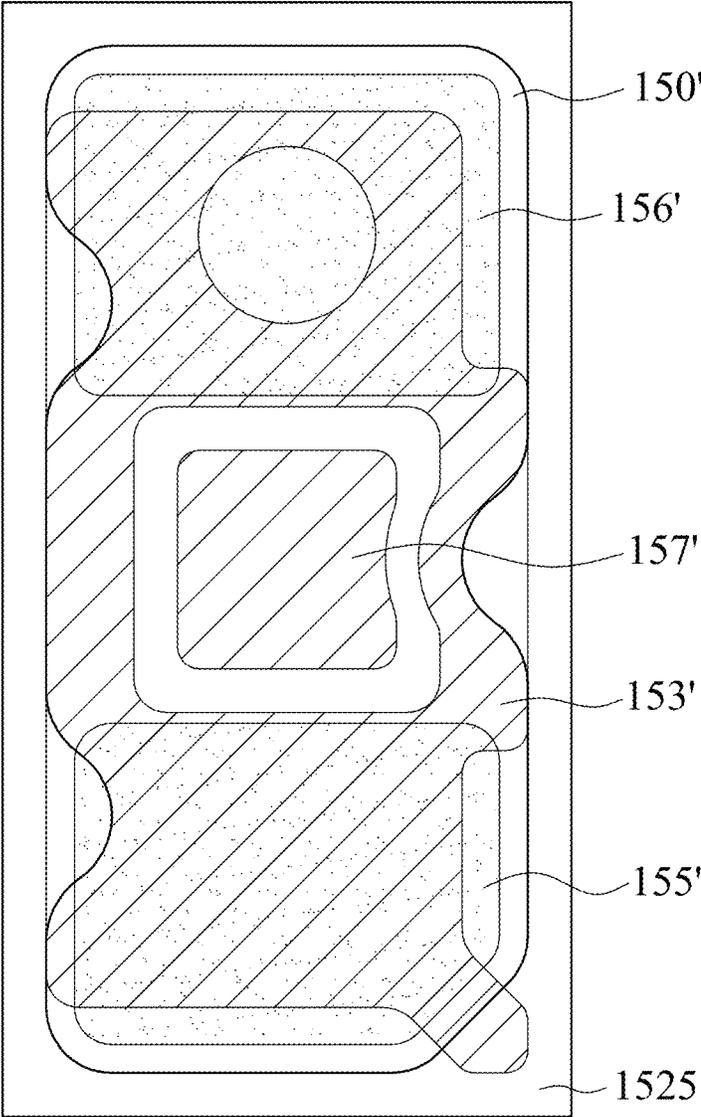


FIG. 13C

	testing quantity	short circuit ratios
conventional light-emitting element	234	33%
light-emitting element of the first embodiment	846	0%

FIG. 14

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LIGHT-EMITTING ELEMENT WITH CRACK PREVENTING CUSHION

REFERENCE TO RELATED APPLICATION

This application is a continuation application of U.S. patent application Ser. No. 15/669,613, filed on Aug. 4, 2017, now granted, which is a continuation application of U.S. Pat. No. 9,761,774, filed on Nov. 23, 2015, now granted, claiming the right of priority based on U.S. 62/092,422, filed on Dec. 16, 2014, and the content of which is hereby incorporated by reference in the entirety.

TECHNICAL FIELD

The disclosure is related to a light-emitting element, and more particularly, a light-emitting element with a cushion part.

DESCRIPTION OF THE RELATED ART

During LED chip package process, LED chips are detached from a blue tape by an ejector pin, picked and placed on a predetermined mounting place one by one via a vacuum chuck. Referring to FIGS. 1A~2C, FIG. 1A shows a top view of a conventional flip chip LED 1. FIG. 1B shows a cross-sectional view of the conventional flip chip LED 1, attached on a blue tape 23, along a line A-A' of FIG. 1A and an ejector pin 21 pushing the blue tape 23 and the conventional flip chip LED 1. The ejector pin 21 can punch through the blue tape 23 and press on a surface of the conventional flip chip LED 1. As shown in FIGS. 1A~1B, the conventional flip chip LED 1 includes a light-emitting stack 10 including a p-type semiconductor layer, a n-type semiconductor layer, and an active layer disposed between the p-type semiconductor layer and the n-type semiconductor layer (not shown), a first pad 15 electrically connecting the n-type semiconductor layer, and a second pad 16 electrically connecting the p-type semiconductor layer. Herein, the ejector pin 21 can be applied to the flip chip LED 1 to detach the flip chip LED 1 from the blue tape 23 which covers an entire top surface of the flip chip LED 1. In detail, the ejector pin 21 is attached to a center region of the flip chip LED 1 located between the first pad 15 and the second pad 16 called gap area 151 for lifting and detaching the flip chip LED 1 from the blue tape 23, and thus the flip chip LED 1 is damaged due to the detaching.

FIG. 2A shows a picture of the conventional flip chip LED 1 damaged due to the detaching, FIG. 2B shows an enlarged partial top view of region C in FIG. 2A, and FIG. 2C shows an enlarged partial top view of region D in FIG. 2B. Since mechanical strength of the flip chip LED 1 is not strong enough, when the ejector pin 21 pushes the flip chip LED 1, the ejector pin 21 will damage the flip chip LED 1 and result in chip damage such as cracks 27 produced in the flip chip LED 1. When current injects into the flip chip LED 1, the crack damage causes short circuits in the flip chip LED 1. The reliability of the flip chip LED 1 will be affected due to the damage accordingly.

SUMMARY OF THE DISCLOSURE

A light-emitting element includes a semiconductor light-emitting stack including a first semiconductor layer, a second semiconductor layer formed on the first semiconductor layer, and an active layer formed therebetween; a first conductive layer disposed on the second semiconductor

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layer and electrically connecting the second semiconductor layer; a second conductive layer disposed on the second semiconductor layer and electrically connecting the first semiconductor layer; and a cushion part disposed on and directly contacts the first conductive layer, wherein in a top view, the cushion part is surrounded by and electrically isolated from the second conductive layer.

A light-emitting element includes a semiconductor light-emitting stack including a first semiconductor layer, a second semiconductor layer formed on the first semiconductor layer, and an active layer formed therebetween; a first conductive layer disposed on the second semiconductor layer and electrically connecting the second semiconductor layer; a second conductive layer disposed on the second semiconductor layer, electrically connecting the first semiconductor layer and including two extension parts; an insulating structure disposed on the first conductive layer and/or the second conductive layer; and a cushion part disposed on the active layer and electrically connecting to the first conductive layer, wherein in a top view, the cushion part is clamped by the two extension parts of the second conductive layer.

A light-emitting element includes a semiconductor light-emitting stack having a first semiconductor layer with a first conductivity, an active layer, and a second semiconductor layer with a second conductivity, a first conductive layer disposed on the semiconductor light-emitting stack and electrically connecting the second semiconductor layer, a first insulating layer disposed on the first conductive layer, a second conductive layer disposed on the first insulating layer and electrically connecting the first semiconductor layer, a second insulating layer on the second conductive layer, a first pad, a second pad, and a cushion part. Herein, the first pad and the second pad are disposed on the second insulating layer, and a cushion part disposed between the first pad and the second pad.

A light-emitting element includes a semiconductor light-emitting stack including a first semiconductor layer, an active layer, and a second semiconductor layer; a first conductive layer disposed on the second semiconductor layer and electrically connecting the second semiconductor layer; a second conductive layer disposed on the second semiconductor layer and electrically connecting the first semiconductor layer; and a cushion part disposed on the semiconductor light-emitting stack; wherein in a top view, the cushion part is disposed in a center region of the light-emitting element.

A light-emitting element includes a semiconductor light-emitting stack including a first semiconductor layer, an active layer, and a second semiconductor layer; a first conductive layer disposed on the second semiconductor layer and electrically connecting the second semiconductor layer; a second conductive layer disposed on the first semiconductor layer and electrically connecting the first semiconductor layer; a first insulating layer disposed on the first conductive layer; a second insulating layer disposed on the second conductive layer; and a cushion part disposed on the active layer and electrically connecting the first conductive layer, wherein a portion of the cushion part is surrounded by the second conductive layer.

BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing is included to provide easy understanding of the application, and is incorporated herein and constitutes a part of this specification. The drawing

illustrates the embodiment of the application and, together with the description, serves to illustrate the principles of the application.

FIG. 1A shows a top view of a conventional flip chip LED.

FIG. 1B shows a cross-sectional view of the conventional flip chip LED, attached on a blue tape, along a line A-A' of FIG. 1A and an ejector pin pushing the blue tape and the conventional flip chip LED.

FIG. 2A shows a picture of the conventional flip chip LED damaged due to the detaching.

FIG. 2B shows an enlarged partial top view of region C in FIG. 2A.

FIG. 2C shows an enlarged partial top view of region D in FIG. 2B.

FIG. 3A shows a top view of a light-emitting element in accordance with a first embodiment of the application.

FIG. 3B shows a cross-sectional view of the light-emitting element along a line E-E' of FIG. 3A.

FIG. 4A shows a top view of a light-emitting element in accordance with a second embodiment of the application.

FIGS. 4B~4L show steps of a process flow of the light-emitting element along a line F-F' of FIG. 4A.

FIG. 5 shows a cross-sectional view of a light-emitting element in accordance with a third embodiment of the application.

FIG. 6A shows a top view of a light-emitting element in accordance with a fourth embodiment of the application.

FIG. 6B shows a cross-sectional view of the light-emitting element along a line G-G' of FIG. 6A.

FIG. 7A shows a top view of a light-emitting element in accordance with a fifth embodiment of the application.

FIG. 7B shows a cross-sectional view of the light-emitting element along a line H-H' of FIG. 7A.

FIG. 8A shows a top view of a light-emitting element in accordance with a sixth embodiment of the application.

FIG. 8B shows a cross-sectional view of the light-emitting element along a line I-I' of FIG. 8A.

FIG. 9A shows a top view of a light-emitting element in accordance with a seventh embodiment of the application.

FIG. 9B shows a cross-sectional view of the light-emitting element along a line J-J' of FIG. 9A.

FIG. 10A shows a top view of a light-emitting element in accordance with an eighth embodiment of the application.

FIG. 10B shows a cross-sectional view of the light-emitting element along a line K-K' of FIG. 10A.

FIG. 11A shows an isometric view of a light-emitting element in accordance with a ninth embodiment of the application.

FIG. 11B shows a top view of each layer of FIG. 11A.

FIG. 12A shows an isometric of a light-emitting element in accordance with a tenth embodiment of the application.

FIG. 12B shows a top view of each layer of FIG. 12A.

FIG. 13A shows a top view of a light-emitting element in accordance with an eleventh embodiment of the application.

FIG. 13B shows a top view of a light-emitting element in accordance with a twelfth embodiment of the application.

FIG. 13C shows a top view of a light-emitting element in accordance with a thirteenth embodiment of the application.

FIG. 14 shows testing data related to short-circuit ratios of light-emitting elements of the first embodiment and the conventional light-emitting element.

DETAILED DESCRIPTION OF THE EMBODIMENTS

To better and concisely explain the application, the same name or the same reference number given or appeared in

different paragraphs or figures along the specification should have the same or equivalent meanings while it is once defined anywhere of the application.

The following shows the description of embodiments of the application in accordance with the drawing.

Referring to FIGS. 3A~3B, FIG. 3A shows a top view of a light-emitting element 3 in accordance with a first embodiment of the application. FIG. 3B shows a cross-sectional view of the light-emitting element 3 along a line E-E' of FIG. 3A. The light-emitting element 3 is adhered on a blue tape 23' and an ejector pin 21' presses on it through the blue tape 23'. As shown in FIGS. 3A~3B, the blue tape 23' covers an entire top surface of the light-emitting element 3. The light-emitting element 3 includes a semiconductor light-emitting stack 30 on a substrate 25', a first conductive layer 31 on the semiconductor light-emitting stack 30, a first insulating layer 32 on the first conductive layer 31, a second conductive layer 33 on the first insulating layer 32 electrically isolated from the first conductive layer 31, a second insulating layer 34 on the second conductive layer 33, a first pad 35, a second pad 36, and a cushion part 37 interposed between the first insulating layer 32 and the second insulating layer 34. The semiconductor light-emitting stack 30 includes a first semiconductor layer with a first conductivity, an active layer, and a second semiconductor layer with a second conductivity (not shown). Herein the first conductive layer 31 electrically connects the second semiconductor layer, and the second conductive layer 33 electrically connects the first semiconductor layer. In the embodiment, a shape of the cushion part 37 in a top view can be a rectangular shape, the material of the cushion part 37 can be metal, and the cushion part 37 is electrically isolated from the first conductive layer 31 and the second conductive layer 33. In another embodiment, the material of the cushion part 37 can be insulating material. In a top view, the cushion part 37 overlaps with the first conductive layer 31, and in a cross-sectional view, the cushion part 37 is substantially coplanar with and surrounded by the second conductive layer 33. The first pad 35 and the second pad 36 electrically connect the first semiconductor layer and the second semiconductor layer via the second conductive layer 33 and the first conductive layer 31, respectively. The cushion part 37 is located between the first pad 35 and the second pad 36 in a top view as shown in FIG. 3A and interposed between the first insulating layer 32 and the second insulating layer 34 in a cross-sectional view as shown in FIG. 3B.

Herein, the ejector pin 21' penetrates the blue tape 23' and then push the light-emitting element 3 to detach the light-emitting element 3 from the blue tape 23'. Because of the cushion part 37 integrated in the light-emitting element 3, while the ejector pin 21' detaches the light-emitting element 3 from the blue tape 23' via pushing the cushion part 37, cracks 27' can be produced nearby the cushion part 37 but not to form conductive paths between the first conductive layer 31 and the second conductive layer 33. Accordingly, in the first embodiment, the cushion part 37 and the first conductive layer 31 are electrically isolated from the second conductive layer 33. Short circuits in the light-emitting element 3 will not happen accordingly.

FIG. 4A shows a top view of a light-emitting element 4 in accordance with a second embodiment of the application. FIGS. 4B~4L show steps of a process flow of the light-emitting element 4 and cross-sectional views along a line F-F' of FIG. 4A. FIG. 4B shows a step of forming a semiconductor light-emitting stack 40 on a substrate 425. In this step, the substrate 425 is provided and the semiconductor light-emitting stack 40 is formed on the substrate 425.

The substrate **425** includes a transparent substrate. A material of the substrate **425** includes transparent material which is transparent with respect to the light emitted from the semiconductor light-emitting stack **40**, such as gallium arsenide (GaAs), gallium phosphide (GaP), gallium nitride (GaN), sapphire, diamond, glass, quartz, acrylic, zinc oxide (ZnO), or aluminum nitride (AlN). Additionally, the substrate **425** can be a conductive substrate or a non-conductive substrate based on the material of the substrate itself or the impurities doped in the substrate. The substrate **425** can be a substrate for epitaxial growth, optionally have a patterned upper surface which can improve epitaxy quality of the semiconductor light-emitting stack **40**, and scatter the light emitted from the semiconductor light-emitting stack **40**.

For improving the quality of the semiconductor light-emitting stack **40**, a buffer layer (not shown) can be formed between the substrate **425** and the semiconductor light-emitting stack **40**. The semiconductor light-emitting stack **40** includes a first semiconductor layer **401**, a second semiconductor layer **403**, and an active layer **402** formed between the first semiconductor layer **401** and the second semiconductor layer **403**. Herein, the first semiconductor layer **401** and the second semiconductor layer **403** are with different conductivities, electricity, polarities, or dopants for providing electrons and holes. The polarity can be an n-type polarity or p-type polarity for supplying electrons and holes, respectively so that electrons and holes can combine in the active layer **402** to emit light. For example, the first semiconductor layer **401** can be an n-type semiconductor layer and the second semiconductor layer **403** can be a p-type semiconductor layer.

The material of the semiconductor light-emitting stack **40** includes aluminum gallium indium phosphide (AlGaInP) base or aluminum gallium indium nitride (AlGaInN) base. The active layer **402** includes single heterostructure (SH), double heterostructure (DH), double-side double heterostructure (DDH), or multi-quantum well (MQW) structure. Specifically, the active layer **402** includes i-type, p-type, or n-type semiconductor. The active layer **402** emits light when electrical current passes through the semiconductor light-emitting stack **40**. When the active layer **402** includes AlGaInP based material, the active layer **402** emits amber series light, such as red light, orange light, or yellow light; when the active layer **402** includes AlGaInN based material, the active layer **402** emits blue, green or UV light. The present embodiment illustrates the semiconductor light-emitting stack **40** with aluminum gallium indium nitride (AlGaInN) based material.

FIG. 4C shows a step of forming a plurality of first depressions **48**. Referring to FIGS. 4A~4C, the plurality of first depressions **48** is formed in the semiconductor light-emitting stack **40** through optical lithography and etching processes. Each of the first depressions **48** penetrates from an upper surface **403a** of the second semiconductor layer **403** into the second semiconductor layer **403**, the active layer **402**, and the first semiconductor layer **401** to expose an upper surface **401a** of the first semiconductor layer **401**. In the embodiment, the plurality of first depressions **48** is a plurality of vias.

FIG. 4D shows a step of forming a first conductive layer **41** having an upper surface **41a**. Firstly, the first conductive layer **41** is formed on the upper surfaces **401a** and **403a** and then a portion of the first conductive layer **41** is removed in accordance with the plurality of first depressions **48** through optical lithography and etching processes. Finally, the first conductive layer **41** is patterned and formed on the upper surface **403a** of the second semiconductor layer **403**. In

another embodiment, the plurality of first depressions **48** can be formed after forming the first conductive layer **41** on the semiconductor light-emitting stack **40**. The etching steps of the semiconductor light-emitting stack **40** and the first conductive layer **41** can be performed at the same time, that is etching parts of the semiconductor light-emitting stack **40** and the first conductive layer **41** at the same step and then the plurality of first depressions **48** is formed to expose the upper surface **401a**. In the embodiment, the first conductive layer **41** electrically connects the second semiconductor layer **403**. Additionally, the first conductive layer **41** has electrical contact with the second semiconductor layer **403** and can be metal material, such as, nickel (Ni), platinum (Pt), palladium (Pd), silver (Ag), or chromium (Cr), aluminum (Al), titanium (Ti), gold (Au), or combinations thereof. In one embodiment, the first conductive layer **41** can include a plurality of layers, for example, a transparent conductive layer (not shown), a reflective layer (not shown) formed on the transparent conductive layer, and a barrier layer (not shown) formed on and covering the reflective layer to prevent migration or oxidation of the reflective layer causing a decrease in the reflectivity. The transparent conductive layer electrically connects the second semiconductor layer **403**, and the reflective layer electrically connects the transparent conductive layer. Light emitting from the active layer **402** can be reflected to the substrate **425** by the reflective layer, and extracted from a surface of the substrate **425** opposite to the active layer **402**. The material of the transparent conductive layer includes ITO (tin-doped indium oxide), AZO (aluminum-doped ZnO), GZO (gallium-doped zinc oxide), or IZO (indium-doped zinc oxide), and so forth; the material of the reflective layer includes silver, gold, copper, or aluminum, and so forth; the material of the barrier layer includes metal materials, for example, titanium (Ti), tungsten (W), aluminum (Al), indium (In), stannum (Sn), nickel (Ni), platinum (Pt), or an alloy including at least one metal selected from the group consisting of Ti, W, Al, In, Sn, Ni, and Pt as described above. Additionally, the barrier layer may include a metal stack such as Ti/Al/Ti/W disposed on the reflective layer.

FIG. 4E shows a step of forming a first insulating layer **42**. Referring to FIG. 4E, the first insulating layer **42** is formed on an upper surface **41a** of the first conductive layer **41**, side walls of the semiconductor light-emitting stack **40**, the first conductive layer **41** and the first depressions **48**, and the upper surface **401a** of the first semiconductor layer **401** in the first depressions **48**. The material of the first insulating layer **42** includes transparent material, for example, SiO₂, TiO₂, or Si₃N₄. Moreover, the first insulating layer **42** can be formed by evaporating, sputtering, or spin-on glass (SOG) coating.

FIG. 4F shows a step of removing portions of the first insulating layer **42** to form second depressions **428** and **428'**. After forming the first insulating layer **42**, portions of the first insulating layer **42** on the upper surface **401a** of the first semiconductor layer **401** and the upper surface **41a** of the first conductive layer **41** are removed through optical lithography and etching processes to form the second depressions **428** and **428'**, respectively. The second depressions **428** penetrate from an upper surface **42a** of the first insulating layer **42** into the first insulating layer **42** and expose the upper surface **401a** of the first semiconductor layer **401**. The second depression **428'** penetrates from an upper surface **42a** of the first insulating layer **42** into the first insulating layer **42** and exposes the upper surface **41a** of the first conductive layer **41**. In the embodiment, the second depressions **428** and **428'** are vias.

FIGS. 4G and 4H show steps of forming a second conductive layer 43 and third depressions 438 and 438'. Firstly, the second conductive layer 43, having an upper surface 43a, is formed to fill the second depressions 428 and 428' and covers a portion of the upper surface 42a of the first insulating layer 42. Herein, the second conductive layer 43 filling in the second depressions 428 electrically connects the first semiconductor layer 401. Then, a portion of the second conductive layer 43 located at a center region of the light-emitting element 4 is removed through optical lithography and etching processes to form the third depressions 438'. Herein, the third depression 438' penetrates from the upper surface 43a of second conductive layer 43 to the upper surface 42a. Moreover, a portion of the second conductive layer 43 filling in the second depression 428' is also removed through the same optical lithography and etching processes to form the third depressions 438 so that the upper surface 41a of the first conductive layer 41 and the upper surface 42a of the first insulating layer 42 are exposed. In the embodiment, the third depression 438 connects and is aligned with the second depression 428', and has a shape corresponding to the aligned second depression 428' in a top view. The third depression 438' is overlapped with the center region of the light-emitting element 4 in a top view. The material of the second conductive layer 43 can be metal material, such as, nickel (Ni), platinum (Pt), palladium (Pd), silver (Ag), chromium (Cr), aluminum (Al), titanium (Ti), gold (Au), or combinations thereof.

FIG. 4I shows a step of forming a cushion part 47. Referring to FIGS. 4A and 4H, the cushion part 47 is formed on the upper surface 42a of the first insulating layer 42 which is exposed by the third depressions 438' and located at the center region of the light-emitting element 4. Further, the cushion part 47 can be surrounded by the second conductive layer 43 and be electrically and physically isolated from the first conductive layer 41 and the second conductive layer 43. In the embodiment, a shape of the cushion part 47 in a top view can be a rectangular shape. A shape of the third depressions 438' in a top view can be a rectangular shape or an elliptical shape. The material of the cushion part 47 can be metal and the same as a material of the second conductive layer 43, such as, nickel (Ni), platinum (Pt), palladium (Pd), silver (Ag), chromium (Cr), aluminum (Al), titanium (Ti), gold (Au), or combinations thereof. In another embodiment, the material of the cushion part 47 can be insulating material or transparent material, for example, SiO₂, TiO₂, or Si₃N₄, and the cushion part 47 can be formed by evaporating, sputtering, or spin-on glass (SOG) coating. The thickness of the cushion part 47 can be designed to bear the detaching strength of the ejector pin to prevent damages of the light-emitting stack during the ejector pin detaching process. In detail, the cushion part 47 with the designed thickness can prevent short circuits between the first conductive layer 41 and the second conductive layer 43 in the light-emitting element 4 due to the cracks of the first insulating layer 42 occurring in the ejector pin detaching process.

FIG. 4J shows a step of forming a second insulating layer 44. Referring to FIG. 4J, the second insulating layer 44 is formed on the upper surface 43a, side walls of the second conductive layer 43, and the upper surface 41a of the first conductive layer 41. In detail, the second insulating layer 44 covers the cushion part 47, and fills into the third depressions 438 and 438'. In one embodiment, the second insulating layer 44 can fill up at least one of the third depressions 438 and 438'.

FIG. 4K shows a step of removing portions of the second insulating layer 44 to form a plurality of fourth depressions 448 and 448'. After forming the second insulating layer 44, a portion of the second insulating layer 44, on the upper surface 43a of the second conductive layer 43, is removed through optical lithography and etching processes to form the fourth depression 448 and expose the upper surface 43a of the second conductive layer 43. In addition, the second insulating layer 44 filling in the third depression 438 is also removed to expose the upper surface 41a of the first conductive layer 41 through the same optical lithography and etching processes and then the fourth depression 448' is formed accordingly. Herein, the fourth depression 448 penetrates from an upper surface 44a of the second insulating layer 44 to expose the upper surface 43a of the second conductive layer 43 and the fourth depression 448' expose the second depression 428' so as to expose the upper surface 41a of the first conductive layer 41. As shown in FIG. 4K, the cushion part 47 is interposed between and encapsulated by the first insulating layer 42 and the second insulating layer 44 in a cross-sectional view.

FIG. 4L shows a step of forming a first pad 45 and a second pad 46. The first pad 45 and the second pad 46 are formed on the second insulating layer 44. Herein, the first pad 45 is formed on one side of the substrate 425 in a top view and fills in the fourth depression 448 for contacting the second conductive layer 43 so as to electrically connect the first semiconductor layer 401. The second pad 46 is formed on another side of the substrate 425 in a top view and fills in the fourth depression 448' for contacting the first conductive layer 41 so as to electrically connect the second semiconductor layer 403. When the light-emitting element 4 electrically connects a power supply (not shown) via the first pad 45 and the second pad 46, the active layer 402 emits light. As shown in the FIGS. 4A and 4L, the cushion part 47 is disposed between the first pad 45 and the second pad 46. As the reason mentioned above, when an ejector pin (not shown) pushes the light-emitting element 4, short circuits will not happen due to the protection of the cushion part 47.

Referring to FIG. 5, it shows a cross-sectional view of a light-emitting element 5 in accordance with a third embodiment of the application. The structure of light-emitting element 5 is similar to that of the light-emitting element 4. For clarifying, in the third embodiment, similar components are labeled by the same reference numbers and the descriptions thereof are omitted herein. The differences between the light-emitting element 5 and the light-emitting element 4 are, in the third embodiment, a second conductive layer 43' covers side walls/surfaces of a first insulating layer 42, outer edges of the second conductive layer 43' excess over outer edges of an active layer 402 and a second semiconductor layer 403 of a semiconductor light-emitting stack 40 in a cross-sectional view as shown in FIG. 5, and the outer edges of the second conductive layer 43' physically contacts a first semiconductor layer 401 of the semiconductor light-emitting stack 40 to form a periphery contacting area. Accordingly, a contact area between the second conductive layer 43' and the first semiconductor layer 401 of the third embodiment is greater than that of the second embodiment. The electrical characteristic of the light-emitting element 5, such as forward voltage, can be better than that of light-emitting element 4. Similarly, when the light-emitting element 5 electrically connects a power supply via a first pad 45 and a second pad 46, the active layer 402 emits light.

Referring to FIGS. 6A~6B, FIG. 6A shows a top view of a light-emitting element 6 in accordance with a fourth embodiment of the application and FIG. 6B shows a cross-

sectional view of the light-emitting element 6 along a line G-G' of FIG. 6A. As shown in FIGS. 6A-6B, the light-emitting element 6 includes a semiconductor light-emitting stack 60 on a substrate 625, a first conductive layer 61 on the semiconductor light-emitting stack 60, a first insulating layer 62 on the first conductive layer 61, a second conductive layer 63 on the first insulating layer 62, a second insulating layer 64 on the second conductive layer 63, a first pad 65, a second pad 66, a cushion part 67 between the first pad 65 and the second pad 66 in a top view, a plurality of first depressions 68, second depressions 628 and 628', third depressions 638 and 638', and fourth depressions 648 and 648'. When the light-emitting element 6 electrically connects a power supply via the first pad 65 and the second pad 66, the active layer 602 emits light.

The structure of the fourth embodiment is similar to that of the second embodiment. The difference between the fourth embodiment and the second embodiment is that the material of the cushion part 67 is insulating material and can be the same as the material of the first insulating layer 62 or the second insulating layer 64. In the embodiment, the cushion part 67 is formed in a center region of the light-emitting element 6 in a top view and interposed between the first insulating layer 62 and the second insulating layer 64 to prevent the crack damage. When an ejector pin (not shown) pushes the center region of the light-emitting element 6, the cushion part 67 can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer 61 and the second conductive layer 63, and short circuits due to the conductive paths will not happen accordingly.

Referring to FIGS. 7A-7B, FIG. 7A shows a top view of a light-emitting element 7 in accordance with a fifth embodiment of the application, and FIG. 7B shows a cross-sectional view of the light-emitting element 7 along a line H-H' of FIG. 7A. The light-emitting element 7 includes a semiconductor light-emitting stack 70, having a first semiconductor layer 701 with a first conductivity, an active layer 702, and a second semiconductor layer 703 with a second conductivity, on a substrate 725, a first conductive layer 71 on the semiconductor light-emitting stack 70, a first insulating layer 72 on the first conductive layer 71, a second conductive layer 73 on the first insulating layer 72, a second insulating layer 74 on the second conductive layer 73, a first pad 75, a second pad 76, a cushion part 77 between the first pad 75 and the second pad 76, a plurality of first depressions 78, second depressions 728 and 728', third depressions 738 and 738', and fourth depressions 748 and 748'. When the light-emitting element 7 electrically connects a power supply via the first pad 75 and the second pad 76, the active layer 702 emits light.

The structure of the fifth embodiment is similar to that of the second embodiment. Similar components are labeled with similar reference numeral and descriptions therewith are omitted herein. Similarly, a shape of the cushion part 77 in a top view includes a rectangular shape. However, the difference between the fifth embodiment and the second embodiment is the location of the cushion part 77. In the embodiment, in order to prevent the crack damage, the cushion part 77 is formed on the second insulating layer 74. In detail, the second insulating layer 74 are formed on the first insulating layer 72, and fills into the third depression 738', overlapped with the center region of the light-emitting element 7. When an ejector pin (not shown) pushes the center region of the light-emitting element 7, the cushion part 77 can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first

conductive layer 71 and the second conductive layer 73, and short circuits due to the conductive paths will not happen accordingly.

Referring to FIGS. 8A-8B, FIG. 8A shows a top view of a light-emitting element 8 in accordance with a sixth embodiment of the application and FIG. 8B shows a cross-sectional view of the light-emitting element 8 along a line I-I' of FIG. 8A. As shown in FIGS. 8A-8B, the light-emitting element 8 includes a semiconductor light-emitting stack 80, having a first semiconductor layer 801 with a first conductivity, an active layer 802, and a second semiconductor layer 803 with a second conductivity, on a substrate 825, a first conductive layer 81 on the semiconductor light-emitting stack 80, a first insulating layer 82 on the first conductive layer 81, a second conductive layer 83 on the first insulating layer 82, a second insulating layer 84 on the second conductive layer 83, a first pad 85, a second pad 86, a cushion part 87 between the first pad 85 and the second pad 86 in a top view, and a plurality of first depressions 88, second depressions 828 and 828', third depressions 838, and fourth depressions 848 and 848'. When the light-emitting element 8 electrically connects a power supply via the first pad 85 and the second pad 86, the active layer 802 emits light.

The structure of the sixth embodiment is similar to that of the second embodiment. Similar components are labeled with similar reference numeral and descriptions therewith are omitted herein. Similarly, a shape of the cushion part 87 in a top view includes a rectangular shape. However, the difference between the sixth embodiment and the second embodiment is the relative positions among the cushion part, the second insulating layer, and the second conductive layer, and the relative process. Referring to the light-emitting element 4 of the second embodiment, the cushion part 47 is formed in the third depression 438', overlapped with a center region of the light-emitting element 4 in a top view, and the cushion part 47 is disposed between the second insulating layer 44 and the second conductive layer 43. Referring to the light-emitting element 8 of the embodiment, the second conductive layer 83, the second insulating layer 84, and the cushion part 87 are formed in a center region of the light-emitting element 8 in sequence. In detail, there is no third depression formed in the second conductive layer 83 to expose an upper surface of the first insulating layer 82, the second insulating layer 84 is located right above the second conductive layer 83. The cushion part 87 is directly formed on the second insulating layer 84 in a cross-sectional view. Moreover, as shown in FIG. 8B, the second conductive layer 83 is continuously overlapped with the center region. Additionally, when an ejector pin (not shown) pushes the center region of the light-emitting element 8, the cushion part 87 can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer 81 and the second conductive layer 83, and short circuits due to the conductive paths will not happen accordingly.

Referring to FIGS. 9A-9B, FIG. 9A shows a top view of a light-emitting element 9 in accordance with a seventh embodiment of the application and FIG. 9B shows a cross-sectional view of the light-emitting element 9 along a line J-J' of FIG. 9A. As shown in FIGS. 9A-9B, the light-emitting element 9 includes a semiconductor light-emitting stack 90, having a first semiconductor layer 901 with a first conductivity, an active layer 902, and a second semiconductor layer 903 with a second conductivity, on a substrate 925, a first conductive layer 91 on the semiconductor light-emitting stack 90, a first insulating layer 92 on the first

conductive layer **91**, a cushion part **97** on the first conductive layer **91** and interposed in the first insulating layer **92** in a cross-sectional view, a second conductive layer **93** on the first insulating layer **92**, a second insulating layer **94** on the second conductive layer **93**, a first pad **95**, a second pad **96**, and a plurality of first depressions **98**, second depressions **928** **928'**, and **928''**, third depressions **938** and **938'**, and fourth depressions **948** and **948'**. Herein, a shape of the cushion part **97** in a top view includes a rectangular shape.

The structure of the embodiment is similar to that of the second embodiment. Similar components are labeled with similar reference numeral and descriptions therewith are omitted herein. In the embodiment, steps and sequences of forming the semiconductor light-emitting stack **90** are similar to that of the second embodiment, and descriptions therewith are omitted herein. The differences between the embodiment and the second embodiment are the positions of second depressions, the cushion part, and the third depressions, and the relative forming steps. Referring to the light-emitting element **9** of the embodiment, in the step of forming the second depressions **928**, **928'**, and **928''**, it further includes removing the first insulating layer **92** overlapped with a center region of the light-emitting element **9** to form the second depression **928''**. Then, the cushion part **97** is formed in the second depression **928''** and contacts the first conductive layer **91**. Afterwards, the second conductive layer **93** and the third depressions **938** and **938'** in the second conductive layer **93** are formed, and then the second insulating layer **94** fills the second depression **928''** and the third depression **938'** to cover the cushion part **97**.

The material of the cushion part **97** can be the same as a material of the first conductive layer **91** or the second conductive layer **93**, such as, nickel (Ni), platinum (Pt), palladium (Pd), silver (Ag), chromium (Cr), aluminum (Al), titanium (Ti), gold (Au), or combinations thereof. In another embodiment, the material of the cushion part **97** can be insulating material or transparent material, such as SiO₂, TiO₂, or Si₃N₄, and the cushion part **97** can be formed by evaporating, sputtering, or spin-on glass (SOG) coating. In the embodiment, when an ejector pin (not shown) pushes the center region of the light-emitting element **9**, the cushion part **97** can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer **91** and the second conductive layer **93**, and short circuits due to the conductive paths will not happen accordingly.

Referring to FIGS. **10A**–**10B**, FIG. **10A** shows a top view of a light-emitting element **10'** in accordance with an eighth embodiment of the application and FIG. **10B** shows a cross-sectional view of the semiconductor light-emitting element **10'** along a line K-K' of FIG. **10A**. As shown in FIGS. **10A**–**10B**, the light-emitting element **10'** includes a semiconductor light-emitting stack **100'**, having first semiconductor layer **1001'** with a first conductivity, an active layer **1002'**, and a second semiconductor layer **1003'** with a second conductivity, on the substrate **1025'**, a first conductive layer **101'** on the semiconductor light-emitting stack **100'**, a first insulating layer **102'** on the first conductive layer **101'**, a second conductive layer **103'** on the first insulating layer **102'**, a second insulating layer **104'** on the second conductive layer **103'**, a first pad **105'**, a second pad **106'**, a cushion part **107'** between the first insulating layer **102'** and the second insulating layer **104'**, and a plurality of first depressions **108'**, second depressions **1028'** and **1028''**, third depressions **1038'** and **1038''**, and fourth depressions **1048'** and **1048''**. When the light-emitting element **10'** electrically

connects a power supply via the first pad **105'** and the second pad **106'**, the active layer **1002'** emits light.

The structure of the eighth embodiment is similar to that of the second embodiment. Similar components are labeled with similar reference numeral and descriptions therewith are omitted herein. However, the difference between the eighth embodiment and the second embodiment is structures of the third depressions and steps of forming the third depressions. Referring to the light-emitting element **4** of the second embodiment, the shapes of the third depressions **438** and **438'** are a circle and an ellipse, respectively. In the eighth embodiment, in the step of forming the third depression **1038''**, a portion of the second conductive layer **103'** is removed and the shape of the removed portion of second conductive layer **103'** is irregular. The shape of the third depressions **1038''** corresponds to that of the removed portion of second conductive layer **103'** with the irregular shape. The cushion part **107'** with a rectangular shape is formed in the third depressions **1038''**, covered by the second insulating layer **104'**, disposed between the first insulating layer **102'** and the second insulating layer **104'**, and located in a center region of the light-emitting element **10'**. When an ejector pin (not shown) pushes the center region of the light-emitting element **10'** for detaching the light-emitting element **10'** from a blue tape, the cushion part **107'** can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer **101'** and the second conductive layer **103'**, and short circuits due to the conductive paths will not happen accordingly.

Referring to FIGS. **11A**–**11B**, FIG. **11A** shows an isometric view of a light-emitting element **11'** in accordance with a ninth embodiment of the application, FIG. **11B** shows a top view of each layer of the light-emitting element **11'** in FIG. **11A**. As shown in FIGS. **11A**–**11B**, the light-emitting element **11'** includes a semiconductor light-emitting stack **110'**, having a first semiconductor layer, an active layer and a second semiconductor layer (not shown in FIGS. **11A**–**11B**), on a substrate **1125**, a first conductive layer **111'** on the semiconductor light-emitting stack **110'**, a first insulating layer **112'** on the first conductive layer **111'**, a second conductive layer **113'** and a cushion part **117'** on the first insulating layer **112'**, a second insulating layer **114'** on the second conductive layer **113'**, and a first pad **115'** and a second pad **116'** on the second insulating layer **114'** respectively.

Steps of forming the light-emitting element **11'** includes forming the semiconductor light-emitting stack **110'** on the substrate **1125** and forming depressions **118'** in the semiconductor light-emitting stack **110'**. Herein, the semiconductor light-emitting stack **110'** is epitaxially grown on the substrate **1125** and portions of the semiconductor light-emitting stack **110'** are etched away to form the depressions **118'**. In the embodiment, the depressions **118'** penetrate into the second semiconductor layer and the active layer from an upper surface of the semiconductor light-emitting stack **110'** to expose an upper surface of the first semiconductor layer. Each of these layers of the semiconductor light-emitting stack **110'** may include a number of sub-layers that vary in composition with respect to one another. The active layer can be constructed from multiple InGaN layers separated by GaN layers. An upper surface of the second semiconductor layer can be roughened by a suitable etching process. When the light-emitting element **11'** electrically connects a power supply via the first pad **115'** and the second pad **116'**, the active layer emits light.

Referring to FIGS. 11A~11B, the steps of forming the light-emitting element 11' further include forming an insulating layer 11a' on the semiconductor light-emitting stack 110' before forming the first conductive layer 111'. Herein, the insulating layer 11a' includes a square ring-like region 11a1' in a top view located on the edges of the semiconductor light-emitting stack 110' and several circle ring-like regions 11a2' corresponding to the positions of the depressions 118'. The square ring-like region 11a1' covers the sidewall of the active layer and the second semiconductor layer. The circle ring-like regions 11a2' cover the sidewalls of the depressions 118' and expose portions of the upper surface of the first semiconductor layer in the depressions 118'. The step of exposing the upper surface of the first semiconductor layer in the depressions 118' can be achieved via the etching and lithography processes.

The first conductive layer 111' includes a first layer 1110' having depressions 111c' and a second layer 1112' having depressions 111d'. The first layer 1110' can be made of ITO, is formed on and covers a surface of the semiconductor light-emitting stack 110' and is devoid of filling in the depressions 118', and the second layer 1112' is formed on the first layer 1110' and is devoid of filling in the depressions 111c'. The second layer 1112' can be a mirror layer, for example, silver, and able to reflect light from the active layer. The first layer 1110' and the second layer 1112' can be deposited over the semiconductor light-emitting stack 110' and electrically connect the second semiconductor layer.

After forming the first layer 1110' and the second layer 1112', the first insulating layer 112' is formed on the second layer 1112'. Herein, the first insulating layer 112' is patterned as shown in FIG. 11B and includes a plurality of depressions 1121' and 1123'. In the step of forming the first insulating layer 112', the first insulating layer 112' is formed on the second layer 1112' and covers side surfaces of the circle ring-like regions 11a2', side surfaces of the depressions 111c' of the first layer 1110', and side surfaces of the depressions 111d' of the second layer 1112'. The first insulating layer 112' is devoid of covering the upper surface of the first semiconductor layer exposed by the circle ring-like regions 11a2' to form the depressions 1121'. The step of forming the depressions 1121' and 1123' can be achieved by the etching and lithography processes. In another embodiment, the circle ring like region 11a2' and the depressions 1121' of the first insulating layer 112' exposing the upper surface of the first semiconductor layer in the depressions 118' can be achieved at the same etching and lithography processes.

Next, the second conductive layer 113' with depressions 1131' and 1133' and the cushion part 117' are formed on the first insulating layer 112' at the same step. A portion of the second conductive layer 113' fills into the depressions 1121' to electrically and physically connect the upper surface of the first semiconductor layer. A center region of the second conductive layer 113' is removed to form the rectangular ring-like depression 1131' and portions of the second conductive layer 113' are removed to form the depressions 1133'. In the embodiment, the cushion part 117' is formed in the depression 1131' and surrounded by the second conductive layer 113'. The cushion part 117' is formed on the center region of the light-emitting element 11' in a top view, and electrically isolated from the second conductive layer 113'. After the second conductive layer 113' and the cushion part 117' are formed, the second insulating layer 114' is formed on the second conductive layer 113' and the cushion part 117' and includes a plurality of depressions 1141' and 1143'. The depressions 1141' expose the second conductive layer 113'. The second insulating layer 114' fills into the depressions

1133' and 1123', covers side surfaces thereof to form the depressions 1143'. Finally, the first pad 115' and the second pad 116' are formed on the second insulating layer 114'. Herein, the first pad 115' electrically connects the second conductive layer 113' via the depressions 1141', and the second pad 116' electrically connects the first conductive layer 111' via the depressions 1143' to provide external contacts for powering the semiconductor light-emitting stack 110'. Similarly, when an ejector pin (not shown) pushes the center region of the light-emitting element 11', the cushion part 117' can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer 111' and the second conductive layer 113', and short circuits due to the conductive paths will not happen accordingly.

Referring to FIGS. 12A~12B, FIG. 12A shows an isometric view of a light-emitting element 12' in accordance with a tenth embodiment of the application and FIG. 12B shows top views of each layers of FIG. 12A. As shown in FIGS. 12A~12B, the light-emitting element 12' includes a semiconductor light-emitting stack 120', having a first semiconductor layer, an active layer and a second semiconductor layer (not shown in FIGS. 12A~12B) formed on a substrate 1225 in sequence, and depressions 128'; an insulating layer 12a', including a square ring-like region 12a1' in a top view located on the edges of the semiconductor light-emitting stack 120' and several circle ring-like regions 12a2' covering the sidewalls of the depressions 128'; a first conductive layer 121' having a first layer 1210' with depressions 121c' and a second layer 1212' with depressions 121d' on the semiconductor light-emitting stack 120'; a first insulating layer 122' with depressions 1221' and 1223' on the first conductive layer 121'; a cushion part 127' and a second conductive layer 123' with depressions 1231' and 1233' on the first insulating layer 122'; a second insulating layer 124' with depressions 1241' and 1243' on the second conductive layer 123'; and a first pad 125' and a second pad 126' on the second insulating layer 124'. In the embodiment, a shape of the cushion part 127' in a top view includes a rectangular shape. Additionally, steps of forming the light-emitting element 12' are similar to that of the light-emitting element 11'. For clarifying, similar descriptions are omitted herein.

Similarly, when an ejector pin (not shown) pushes the center region of the light-emitting element 12', the cushion part 127' can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer 121' and the second conductive layer 123', and short circuits due to the conductive paths will not happen accordingly.

FIG. 13A shows a top view of a light-emitting element 13' in accordance with an eleventh embodiment of the application. The light-emitting element 13' includes a semiconductor light-emitting stack 130' on a substrate 1325, a first conductive layer 131' on the semiconductor light-emitting stack 130', a first insulating layer (not shown) on the first conductive layer 131', a second conductive layer 133' on the first insulating layer, a second insulating layer (not shown) on the second conductive layer 133', a first pad 135', a second pad 136', and a cushion part 137' electrically connects the first conductive layer 131'. Herein, a shape of the cushion part 137' in a top view includes a rectangular shape. The structure and material of the cushion part 137' is similar as that of the cushion part 97 in the seventh embodiment, and a detailed description is omitted herein.

FIG. 13B shows a top view of a light-emitting element 14' in accordance with a twelfth embodiment of the application. The light-emitting element 14' includes a semiconductor

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light-emitting stack **140'** on a substrate **1425**, a first conductive layer (not shown) on the semiconductor light-emitting stack **140'**, a first insulating layer (not shown) on the first conductive layer, a second conductive layer **143'** with an irregular shape formed on the first insulating layer, a second insulating layer (not shown) on the second conductive layer **143'**, a first pad **145'**, a second pad **146'**, and a cushion part **147'** formed in a center region without being covered by the second conductive layer **143'**. At least a portion of the first insulating layer and the second insulating layer are formed in a center region of the light-emitting element **14'** and the material of the cushion part **147'** is the same as that of the first insulating layer or the second insulating layer. The structure, location, and material of the cushion part **147'** are similar as that of the cushion part **67** in the fourth embodiment, and a detailed description is omitted herein.

FIG. **13C** shows a top view of a light-emitting element **15'** in accordance with a thirteenth embodiment of the application. The light-emitting element **15'** includes a semiconductor light-emitting stack **150'** on a substrate **1525**, a first conductive layer (not shown) on the semiconductor light-emitting stack **150'**, a first insulating layer (not shown) on the first conductive layer, a second conductive layer **153'** on the first insulating layer, a second insulating layer (not shown) on the second conductive layer **153'**, a first pad **155'**, a second pad **156'**, and a cushion part **157'**. The cushion part **157'** is formed on the second insulating layer and located in a center region without being covered by the second conductive layer **153'**. In the embodiment, a portion of the second conductive layer **153'** is removed and the shape of the removed portion of the second conductive layer **153'** is irregular. A shape of cushion part **157'** corresponds to the shape of the removed portion of the second conductive layer **153'** and includes an irregular shape. Similarly, when an ejector pin (not shown) pushes a center region of the light-emitting element **15'**, the cushion part **157'** can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer and the second conductive layer **153'**, and short circuits due to the conductive paths will not happen accordingly.

In above embodiments (the eleventh embodiment to the thirteen embodiment), when an ejector pin (not shown) pushes the light-emitting element, the cushion part can absorb part of the strength from the ejector pin to prevent from conductive paths occurring between the first conductive layer and the second conductive layer, and short circuits due to the conductive paths will not happen accordingly.

FIG. **14** shows testing data presenting short-circuit ratios of light-emitting elements of the first embodiment and a conventional light-emitting element. As shown in FIG. **14**, testing quantity of the light-emitting element of the first embodiment and the conventional light-emitting element are **846** and **234** respectively. Short-circuit ratios of the light-emitting element of the first embodiment and the conventional light-emitting element are zero and 33%. Therefore, the light-emitting element of the application can prevent short circuits due to the damage in the detaching process.

The principle and the efficiency of the present application illustrated by the embodiments above are not the limitation of the application. Any person having ordinary skill in the art can modify or change the aforementioned embodiments. Therefore, the protection range of the rights in the application will be listed as the following claims.

What is claimed is:

1. A light-emitting element comprises:
a semiconductor light-emitting stack comprising a first semiconductor layer, a second semiconductor layer

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formed on the first semiconductor layer, and an active layer formed therebetween;

a first conductive layer disposed on the second semiconductor layer and electrically connecting the second semiconductor layer;

a second conductive layer disposed on the second semiconductor layer and electrically connecting the first semiconductor layer; and

a cushion part disposed on and directly contacts the first conductive layer,

wherein the cushion part is surrounded by and electrically isolated from the second conductive layer, and the cushion part electrically connects to the first conductive layer.

2. The light-emitting element of claim **1**, further comprising one or a plurality of first depressions formed in the semiconductor light-emitting stack and penetrating the second semiconductor layer and the active layer to expose a surface of the first semiconductor layer.

3. The light-emitting element of claim **1**, further comprising an insulating structure disposed on the first conductive layer.

4. The light-emitting element of claim **3**, wherein the cushion part is interposed between the first conductive layer and the insulating structure.

5. The light-emitting element of claim **3**, wherein the insulating structure comprises a first insulating layer disposed on the first conductive layer and a second insulating layer disposed on the first insulating layer.

6. The light-emitting element of claim **5**, further comprising one or a plurality of first depressions formed in the semiconductor light-emitting stack and penetrating the second semiconductor layer and the active layer to expose a surface of the first semiconductor layer.

7. The light-emitting element of claim **6**, wherein the first insulating layer covers a side wall of the one or the plurality of first depressions, and the second conductive layer fills in the one or the plurality of first depressions.

8. The light-emitting element of claim **7**, further comprising a first pad and a second pad disposed on the active layer, wherein the first pad electrically connects to the first semiconductor layer via the second conductive layer in the one or the plurality of first depressions.

9. The light-emitting element of claim **1**, further comprising a first pad and a second pad disposed on the semiconductor light-emitting stack and respectively electrically connecting to the first conductive layer and the second conductive layer, wherein in a top view, the cushion part is disposed between the first pad and the second pad.

10. The light-emitting element of claim **1**, wherein a material of the cushion part comprises metal or an insulating material, or a material of the cushion part is the same as a material of the second conductive layer or the first conductive layer.

11. The light-emitting element of claim **1**, wherein a shape of the cushion part comprises a symmetrical shape in a top view.

12. The light-emitting element of claim **1**, wherein in a top view, the cushion part is disposed in a center region of the light-emitting element.

13. A light-emitting element comprises:
a semiconductor light-emitting stack comprising a first semiconductor layer, a second semiconductor layer formed on the first semiconductor layer, and an active layer formed therebetween;

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a first conductive layer disposed on the second semiconductor layer and electrically connecting the second semiconductor layer;

a second conductive layer disposed on the second semiconductor layer, electrically connecting the first semiconductor layer and comprising two extension parts;

an insulating structure disposed on the first conductive layer and/or the second conductive layer; and

a cushion part disposed on the active layer and electrically connecting to the first conductive layer, wherein the cushion part is clamped by the two extension parts of the second conductive layer.

14. The light-emitting element of claim 13, wherein a material of the cushion part is the same as a material of the second conductive layer or a material of the first conductive layer.

15. The light-emitting element of claim 13, further comprising a first pad and a second pad respectively electrically

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connecting to the first conductive layer and the second conductive layer, wherein in a top view, the cushion part is disposed between the first pad and the second pad.

5 16. The light-emitting element of claim 13, wherein in a top view, the cushion part is disposed in a center region of the light-emitting element.

10 17. The light-emitting element of claim 13, wherein a shape of the cushion part comprises a symmetrical shape in a top view.

18. The light-emitting element of claim 13, wherein the cushion part is devoid of overlapping with the second conductive layer in a cross-sectional view.

15 19. The light-emitting element of claim 13, wherein the cushion part is in direct contact with the first conductive layer.

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